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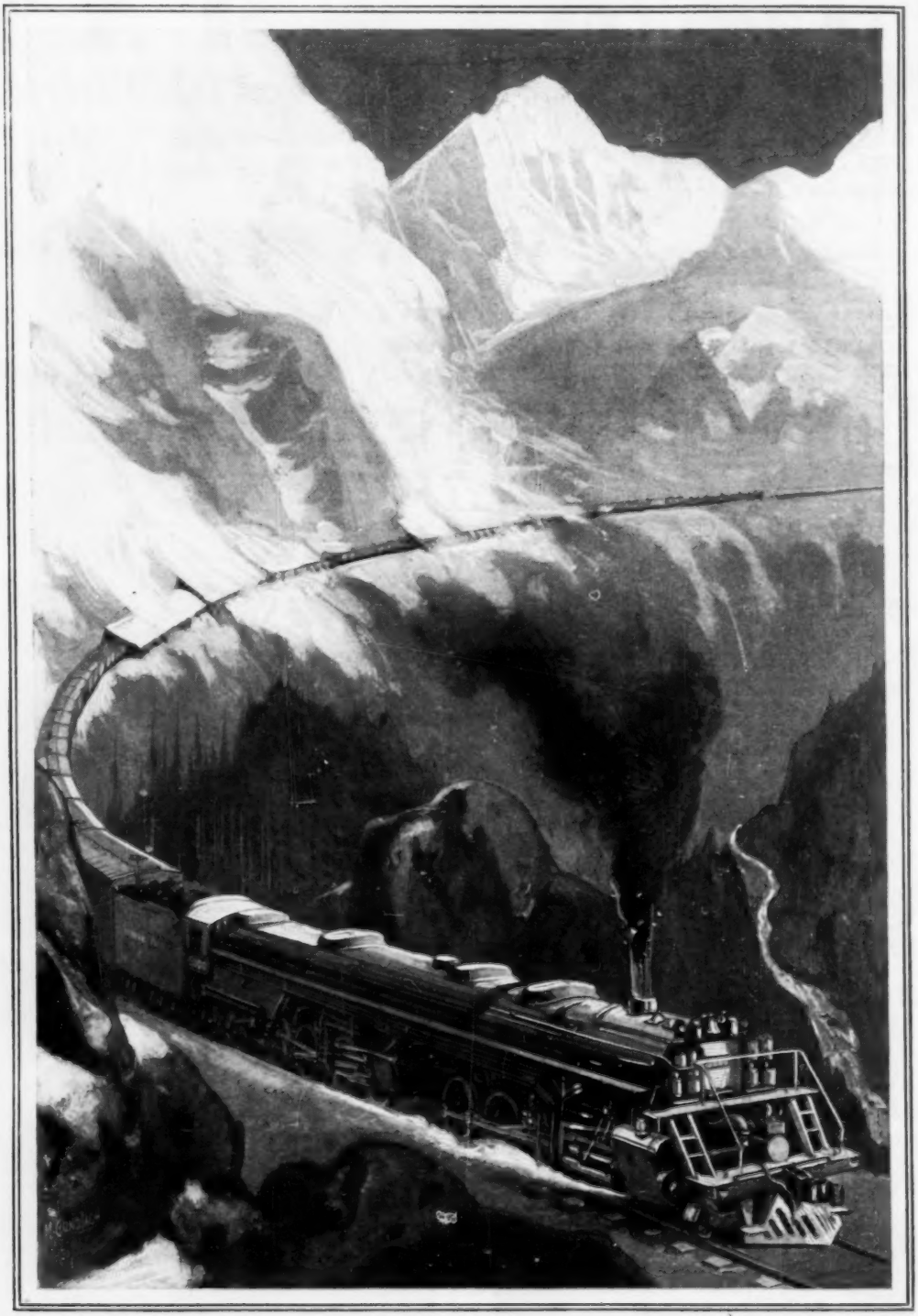

A Giant of the Rails at Work among the Mountains; Drawing of One of the Northern Pacific Railway Company's Monster Locomotives Hauling Long Train up a Steep Grade—See Page 96

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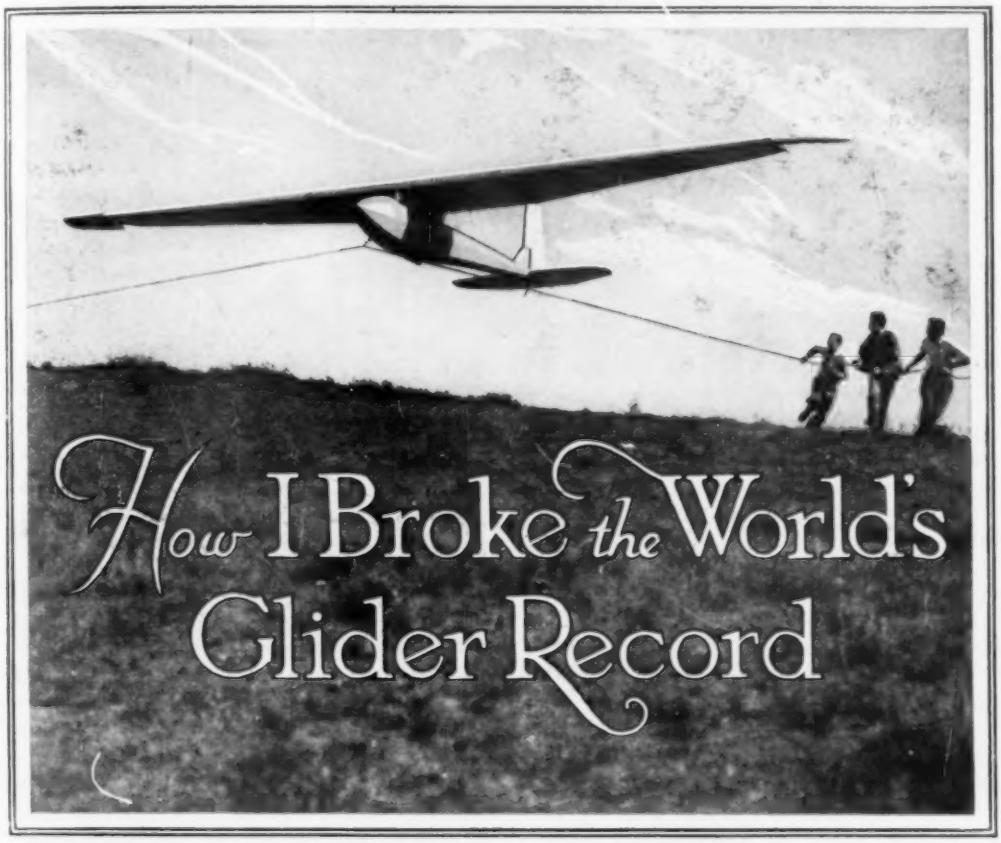


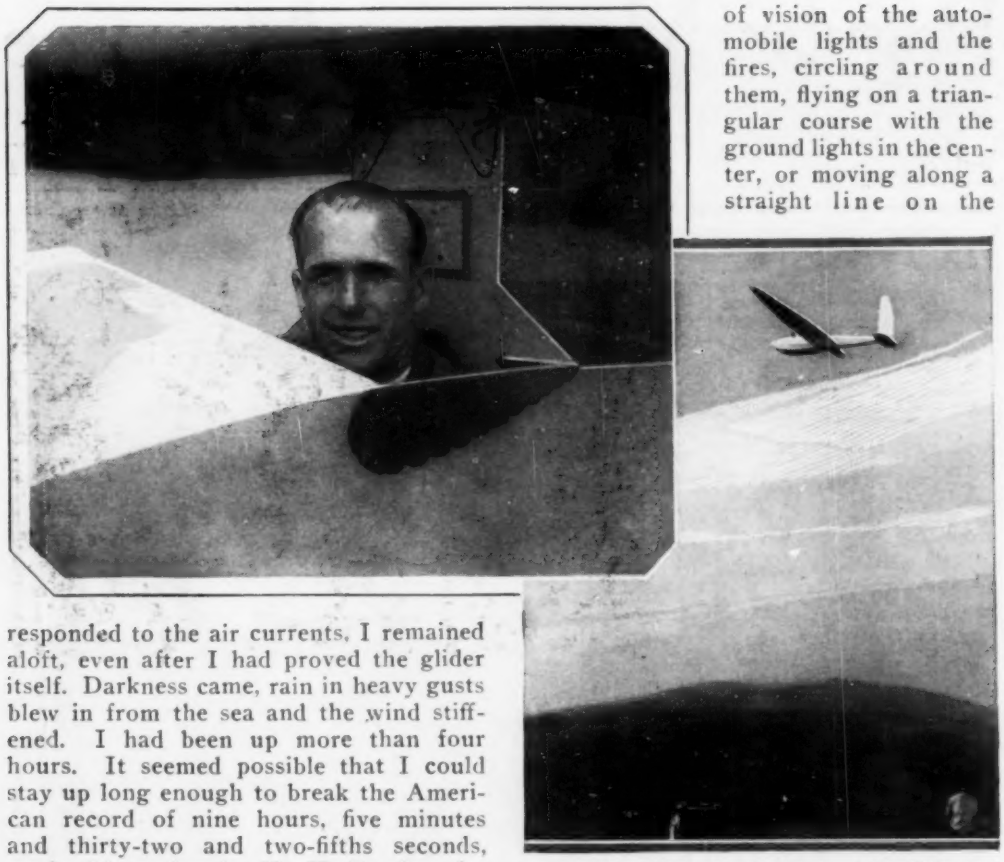
Barstow Being Catapulted into the Air from the Top of Point Loma in His Sixty-Foot Sailplane for the Start of His Flight of Fifteen Hours and Twelve Minutes

By JACK BARSTOW

I DIDN'T start to make or break any records, when I took off into a south wind from the top of Point Loma, near San Diego, a little after noon on April 29. I went up to try out a Bowlus sailplane and to see if I could take off from the point, 750 feet above the ocean, into a south wind, which the glider-theory experts had said couldn't be done.

When I landed, almost at the spot from which I was catapulted into the air, it was near four o'clock of the morning of April 30. I had been in the air fifteen hours and twelve minutes, beating the American record by more than six hours, and the world record of Lieutenant Dinort, in Germany—fourteen hours and forty-five minutes—by twenty-seven minutes.

Though I had no barograph, I am certain, owing to the strength of the wind and the rate at which I was climbing, that during the night I reached an altitude of at least 1,000 feet above sea level, or more than 250 feet above the starting point of the flight. I had on only light summer clothing and no supplies, not even water. But as I felt the power of the wind and saw how easily the sailplane



The Record Breaker in the Cockpit of the Glider and Skimming along About 200 Feet above Ground

responded to the air currents, I remained aloft, even after I had proved the glider itself. Darkness came, rain in heavy gusts blew in from the sea and the wind stiffened. I had been up more than four hours. It seemed possible that I could stay up long enough to break the American record of nine hours, five minutes and thirty-two and two-fifths seconds, made this spring by W. H. Bowlus, designer and builder of the sailplane I flew, also flying over Point Loma. I did not feel the cold, hunger or thirst, but I did miss a cushion. The controls worked perfectly.

William Van Dusen, official representative of the National Aeronautical association, held the watch on me throughout the flight. I could see the lights of the automobiles and the watch fires of my companions on the point below, but I could see nothing of the ocean, though I could hear its roar. To right and left and above, I seemed to be floating in a soft mass of gray down, through which it was impossible to see. I could not tell in which direction I was flying, so I kept within a radius of vision of the automobile lights and the fires, circling around them, flying on a triangular course with the ground lights in the center, or moving along a straight line on the coast, until the lights became dim, when I would turn and go back.

You have no idea how lonely it is, with no roaring motor to hear, no fellow flyer to talk to, nothing but the silence, with an occasional creak from some part of the glider, or the whimper of the wind through the plane. I climbed until I could hardly see the lights and then voluntarily came down—a thing a glider pilot rarely dares do—until I could see them, when I found no difficulty in rising again, so strong was the wind.

Ten hours went by, busy but slow hours; busy, because every nerve, every muscle, was working to take advantage of every

BELIEVING that gliding is one of the most interesting of all sports and that it is the least expensive way of obtaining flying experience, Popular Mechanics will print next month a fascinating article on "I Learn to Fly a Glider," by "Bud" Perl, a sixteen-year-old boy.—The Editor.

gust, to lift the sailplane up the wind, to carry it across the air currents and still lose no altitude or lifting power. It was like being the mind and body of a bird, dependent only on the very wind itself for movement and elevation. Several times I sailed out over the ocean, which I could hear pounding on the rocks below.

At the end of these ten hours, I knew I had beaten the American record, and then I determined to stick it out for the world mark, if I could make it. I tried to fly blind, crouching down in the cockpit, so that my head and face were protected from the wind-blown mist, but I found this would not work. I needed all my faculties, up and out, to keep within range of the light of those fires and automobiles.

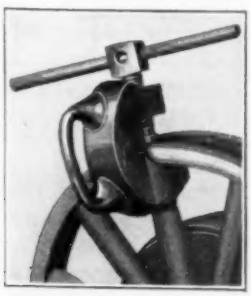
About 3:45 in the morning, the wind began to die down. I managed to stay up for eleven minutes more, but at 3:56 was forced to come down, landing very close to the point of take-off, fifteen hours and twelve minutes earlier.

Closely Guarded Launching of American Yacht "Enterprise," Possible Defender of America Cup against Sir Thomas Lipton's "Shamrock V"

AMERICAN YACHT-RACE ENTRY TAKES TO THE WATER

Surrounded by secrecy, the trim little yacht "Enterprise," possible defender of the America cup against Sir Thomas Lipton's "Shamrock V," recently was launched at Bristol, R. I., following its formal christening. The yacht will compete with other boats for the honor of defending American supremacy against the Lipton entry. The launching took place in the early morning to avoid sight-seers, and the boat was closely guarded to prevent its details from becoming known.

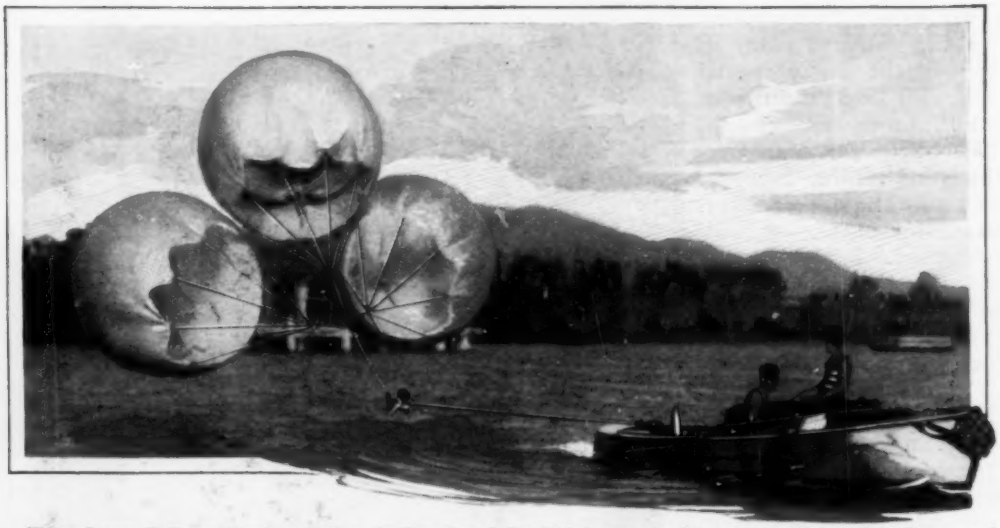
TIGHTENING SPOKES ON WHEEL ENDS AUTO SQUEAKS



With the aid of a portable tightener now on the market, wooden automobile spokes are quickly readjusted, eliminating unpleasant noises, strengthening the wheel and correcting its alinement. The spoke is pressed in at the hub, the steel felloe is reset against the shoulder of the spoke, and the tenon is set tight around the neck, all in one operation and without disturbing the bearings.

ELECTRIC ENERGY IN MILK FAT GOVERNS CREAM CONTENT

Cream content of milk can be increased by diminishing the electric charges carried by the fat globules. These globules normally carry a negative charge which is decreased by heating to 142 degrees, and increased above that temperature. The cream layer on a bottle of milk is deeper under conditions causing a decrease in charge, as in pasteurizing.



Three Large Balloons Used to Pull a Surfboard and Its Rider over the Water; the Photograph Shows a Motorboat Towing the Balloons and the Rider Back to the Starting Point

BALLOONS DRAW SURFBOARD AND RIDER OVER WATER

Three large balloons have replaced the motorboat as a means of motive power for surfboard riders. The balloons, traveling with the wind, draw the board and rider over the surface of the water, often at a fast clip, and when the end of the course is reached, a motorboat tows the board, rider and balloons back.

CRUDE OIL CHANGED TO EQUAL AMOUNT OF GASOLINE

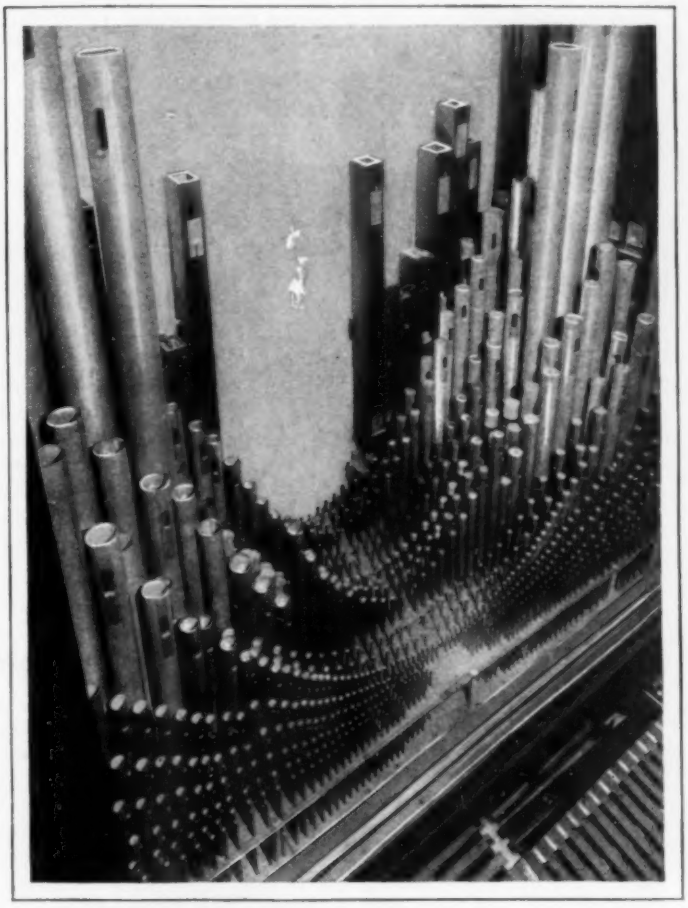
Hydrogenation, the process of turning oils into lighter ones by adding hydrogen, is being employed commercially in the United States today as a means of producing 100-per-cent colorless gasoline from a given volume of crude oil or fuel oil. Refinery processes heretofore used have averaged about forty-two per cent of gasoline from a barrel of crude oil. The process, developed in Germany as a war-time necessity, also can be applied to coal, which can be made to yield gasoline and oil. Coal is carbon, and oil is carbon plus hydrogen, and the more hydrogen in proportion to carbon content, the lighter the product. The German process has been to add hydrogen atoms under great heat and pressure, in order to make lighter compounds. A German plant already has produced a high-grade gasoline from coal, and three plants are being erected in the United States for work with crude oil. The process which converts coal reserves into potential oil reserves, and gives a 100-per-cent yield of gasoline from crude oil, removes the possibility of a motor-fuel shortage as a factor in American automotive development, and removes from the petroleum industry the problem of disposing of the overproduction of by-products that have been obtained through refining processes heretofore employed.

TABULATOR FOR BRIDGE SCORE LIKE ADDING MACHINE

Operating like a vest-pocket adding machine, a bridge-score tabulator keeps a running record of total points and honors, accomplishing most of the task automatically. It works by manipulating tabs before digits with a pencil point placed in dots for this purpose, the process causing totals to be checked in columns at the top. It also shows the number of the hand.

SHOWER BATHS FOR CABBAGES

Shower baths for cabbages that are to be used for sauerkraut improve the quality of the product, agricultural experts at the University of Wisconsin have found. Washing the cabbage in a stream of running water before cutting removes from sixty to seventy per cent of the bacteria normally present on the leaves. The outside of the head contains from fifty to sixty million bacteria per ounce and the inside about 40,000. The latter are beneficial in kraut making, but only one-fourth of the outer ones are of the desirable type. Washing produces kraut superior in flavor and aroma.



Courtesy The Illustrated London News

Bird's-Eye View of a Pipe Organ; a Photograph Taken Looking Downward on the Pipes of an Organ in a Paris Concert Hall

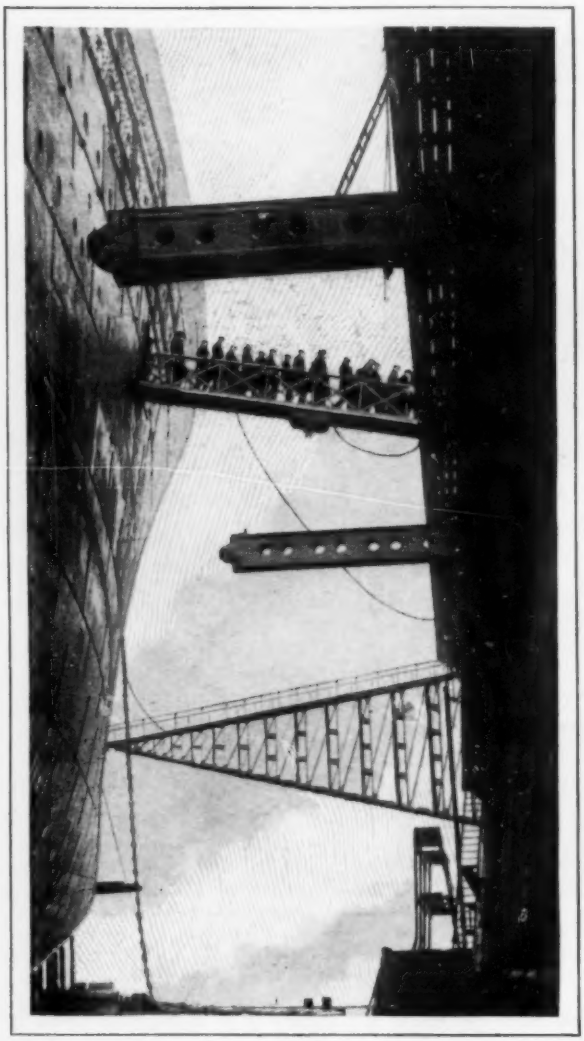
BICYCLE-CANOE IS DRIVEN BY PEDAL SIDEWHEEL

Some of the principles of the old sidewheel river boat, the bicycle and the ordinary canoe are combined in a bicycle-boat for water travel. It is a canoe fitted with sidewheel paddles propelled by pedals and guided by handlebars. The latest sidewheeler also can be operated by a motor.

Canoe Fitted with Sidewheel Paddles, Handlebars and Pedals for Guiding and Propelling the Bicycle-Boat

DENSE FOREST OF ORGAN PIPES SHOWN IN UNIQUE PHOTO

"Pipes of the modern Pan" might be an appropriate title for an unusual picture, taken from above, of the pipes and part of the keyboard of a great organ in a Paris concert hall. The downward photograph of the forest of pipes of varying sizes might easily be mistaken for a bird's-eye view, taken from a considerable altitude, of the skyscrapers of a modern city with graduated rows of smaller buildings clustering about them.



Workmen Passing over Bridge Suspended between the Giant Liner "Olympic" and Top of Her Floating Dock

BRIDGE FROM SHIP TO DOCK SHOWS SIZE OF LINER

Workmen boarding and leaving the giant liner "Olympic," while the vessel lay in her floating dock at Southampton, England, traveled by way of an overhead bridge swung from the side of the ship to the surface of the dock. The arrangement gave a startling impression of the mammoth proportions of the liner viewed from below, where the spectator, gazing upward, saw on one side the vast bulk of the towering vessel, on the other the rising dock, and between them the narrow bridge spanning the canyon across which seemingly tiny workmen passed back and forth.

AN IMAGINARY FLIGHT TO SUN PICTURED BY SCIENTIST

If it were possible to speed through space at the rate of 10,000 miles an hour, a trip from the earth to the sun would consume about thirteen months, and it would cost at least $50,000,000 a minute to keep the traveler alive after he got there. Such is the calculation of Prof. John Q. Stewart, of Princeton University, who recently described an imaginary trip from the earth to the center of the sun as the fanciful possibility of some remote future explorers. Making the astronomical flight of fancy in a space ship traveling 10,000 miles per hour, three minutes would be required to reach the top of the earth's atmosphere, one day to come to the moon's orbit, three and one-half months to reach the orbit of Venus and four and one-half months more to travel to the orbit of Mercury. From this point to the sun's corona would require four and one-half months; two weeks would be required to traverse the corona, and an hour to go through the chromosphere. It would take four seconds each to go through the intermediate layer and photosphere, and the journey on to the sun's center would be made in forty-two hours. To make habitable a space of ten cubic feet in the ship at the sun's surface would require refrigerating machinery rated at 60,000 kilowatts, and at the center, where temperature has been estimated at 40,000,000 degrees Centigrade, the power required to keep cool would be multiplied 4,000 trillion times. If power cost one-thousandth cent a kilowatt-century, a billion times cheaper than the usual present rate, the refrigerating bill to keep the traveler alive would reach the enormous amount mentioned above.

AUTO THAT FLOATS, SUBMERGES OR FLIES IN THE AIR

Experiments recently have been conducted by the Danish government with an automobile that can be converted at will into a boat, a submarine, or an airplane. The four-element craft can travel over land on pneumatic tires, launch itself into the sea as a boat, convert itself into an underseas craft, and, upon coming to the surface, unfurl telescoping wings and rise into the air. In appearance it resembles a tapering, all-metal boat hull with wings which can be folded by switches inside the hull. Before submerging, the wings are folded and watertight compartments are closed. On the surface of the water, the craft can be steered like an ordinary boat by means of rudder and screw. The wheels under the body can be raised or lowered.

Demonstrating with a Small Model the Method of Stopping a Train with a Beam of Light from an Electric Eye

"ALADDIN'S LAMP" HALTS TRAIN WITH BEAM OF LIGHT

Demonstration of a method of halting trains by the action of a beam of light, was made with a small model recently. A small hand lamp casts a ray which strikes a light cell on the front of the engine. The cell then causes the brakes of the train to be applied through the action of relays set in operation by the effect of the light upon the cell.

LOW-WING METAL MONOPLANE DEVELOPS HIGH SPEED

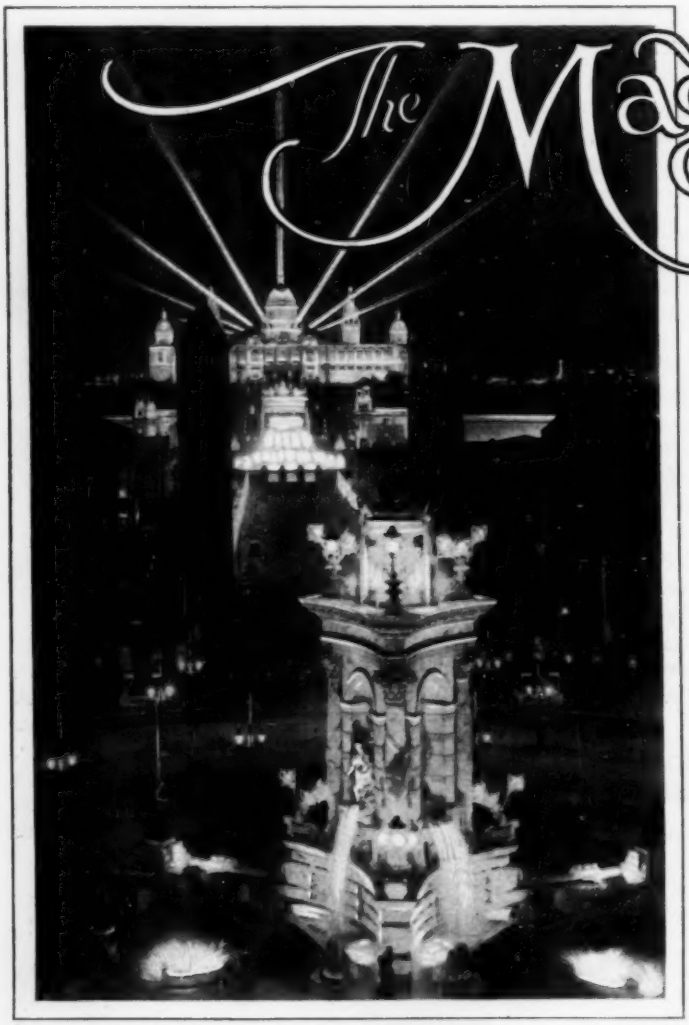
Driven by a 435-horsepower motor, an all-metal, low-wing cabin monoplane, the first of its kind in this country, recently was completed by James K. Northrop, creator of the "flying wing" plane. The low-wing metal ship has a top speed of about 180 miles an hour and a cruising speed of about 150 miles.

All-Metal, Low-Wing Cabin Monoplane, Whose 435-Horsepower Motor Develops a Cruising Speed of 150 Miles an Hour or More

ROADS OF STEEL RESIST WEAR

Highways of steel are being tested in England on routes where exceptionally heavy traffic ruins the ordinary road very quickly. The road is built with a concrete base on which steel plates are laid, intersections being filled with concrete or asphalt. Shocks created by traffic are dissipated over a considerable area instead of being localized. Such a road is claimed to wear at least twice as long as one built of any other known type of material, and even if the foundation sank, to form a safe bridge.

The Magic of



Entrance and One of the Squares of the Exhibition Grounds in Barcelona, Spain, as They Appeared at Night

By DON GLASSMAN

ARCHITECTURE of the night evolves under the sunglare of electricity and the magic of invention. Cities of men are no longer dim patches of flickering light against the heavens.

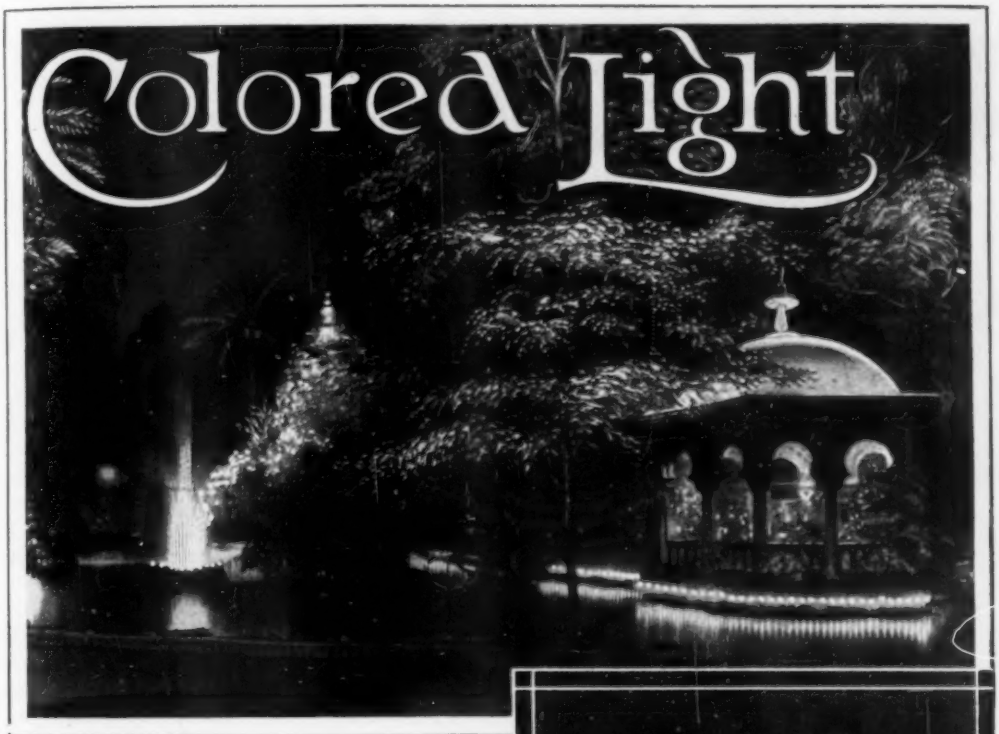
Engineers are directing powerful beams into the skies, painting skyscraper towers in pastel glows; in short, are transforming city nights into fairy wonderlands, where the dreams of inventors vie with star clusters and satellites.

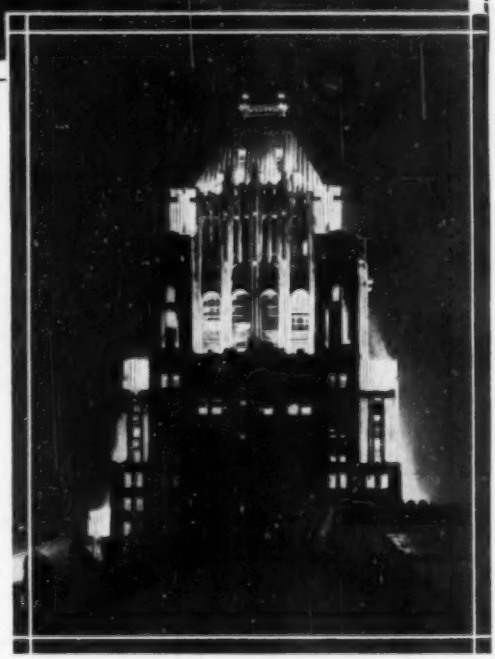
Aside from the perfection of lighting equipment, the last several years have seen skyscrapers planned and constructed with special provision for floodlighting. In choosing face stone for buildings, architects give close consideration to the effects of this illumination on the background. Hand in hand with the new architecture, which is making extensive use of colored terra cotta and tinted brick, the floodlighting engineer is experimenting with hundreds of different beams, thrown on varying surfaces, to learn their effect.

Another important advance is underwater lighting. Of course, the illumination of cataracts and fountain sprays is not new, but the underwater illumination of swimming pools, bathing beaches and aquariums by lighting units in the water is a special field which is attracting great interest.

Still another advance is the adoption of the photoelectric cell in standard sign-lighting equipment. Everybody knows how sensitive this cell is to light. It was just recently conceived that such a cell could easily displace a clock in turning current on or off. The operation is very simple; whenever natural illumination falls below a certain intensity, no matter what hour of the day, the cell completes a circuit and the current is turned on. This invention alone will save thousands of dollars in the cost of keeping men to handle switchboards for lighting units.

Colored Light



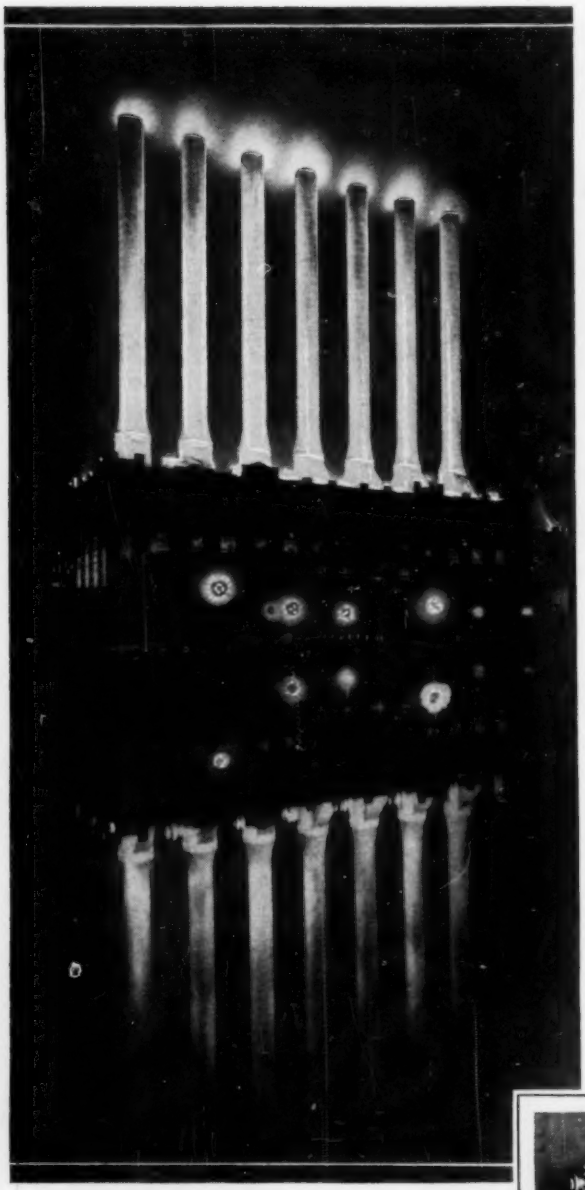


Illuminated Gardens of the Seville Exposition, and Floodlighted Tower of the Fisher Building in Detroit

The depiction of moving figures, flashing colors and animated signs is achieved in a new invention which shortly will be thrown on the market. The signboard of this device is honeycombed like a bee's hive, and by the proper manipulation of lights, it is possible to light-paint any conceivable design and change it at will. This is the most sensational development in illuminated signs since engineers learned how to make electricity flow down a bank of bulbs like a cataract.

And what about light etching and color mixing? The present tendency is to make the city night look like a brilliant canvas. Engineers have found white light alone to be unattractive and somewhat dull when applied to all buildings and monuments along the horizon. They play with the rainbow, with a view to kidnaping its colors. The expositions at Barcelona and Seville last year showed how successful have been their attempt to diffusé white light into soothing pastel tints that are not blinding, and give the effect of weird artistry.

The mixing of colors and the sculpture of shadows are two fascinating studies that are now being carried on with intensity. Examples of color lighting on buildings are still rare, largely because architects have never demanded such from engineers. But the new set-back architec-



ture lends itself so excellently to color lighting that the field can no longer suffer neglect. Building operators also realize the advantage of distinctive lighting.

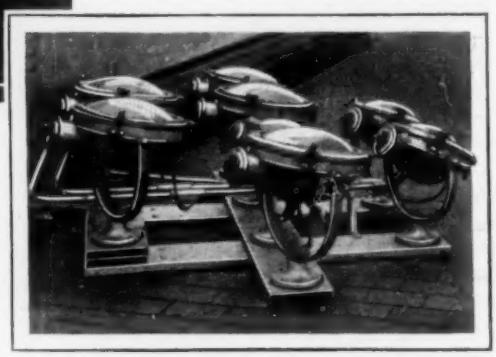
"The tendency today," a leading floodlighting engineer, A. Paulus, told me at the famous Westinghouse light laboratory, Bloomfield, N. J., "is to get variation in intensity and some relief.

"That is, we want to leave dark spaces between light spaces. We seek to illuminate columns, shafts and pylons. And to relieve flatness, we are trying to effect color contrast. We might call this shadow-lighting. Until a few years ago, we knew only white lighting in architecture. Today we have the 'still color effect,' which gives different intensities and colors on different set-backs.

"The second impression we have almost perfected is the 'mobile color effect,' in which colors change continually. These effects are carried out with two wattages. If you start with one intensity for white light, you cannot use the same intensity for blue, because the latter absorbs light differently. Amber light has the lowest absorption, followed in succession by red, blue and green.

"In order to achieve a pleasing effect and even intensity, you must adjust the intensity of one color to another. For instance, in blending white and blue, you may have to step up the wattage of blue ten or fifteen times to meet the white-light intensity. But if you do not care to blend these colors, stepping up is unnecessary. In that case, different intensities are not so displeasing.

"As a substitute for mobile color, we have the 'wash-out system.' In this method we use one primary color—red, blue, or yellow—with white light. The primary color burns continually,

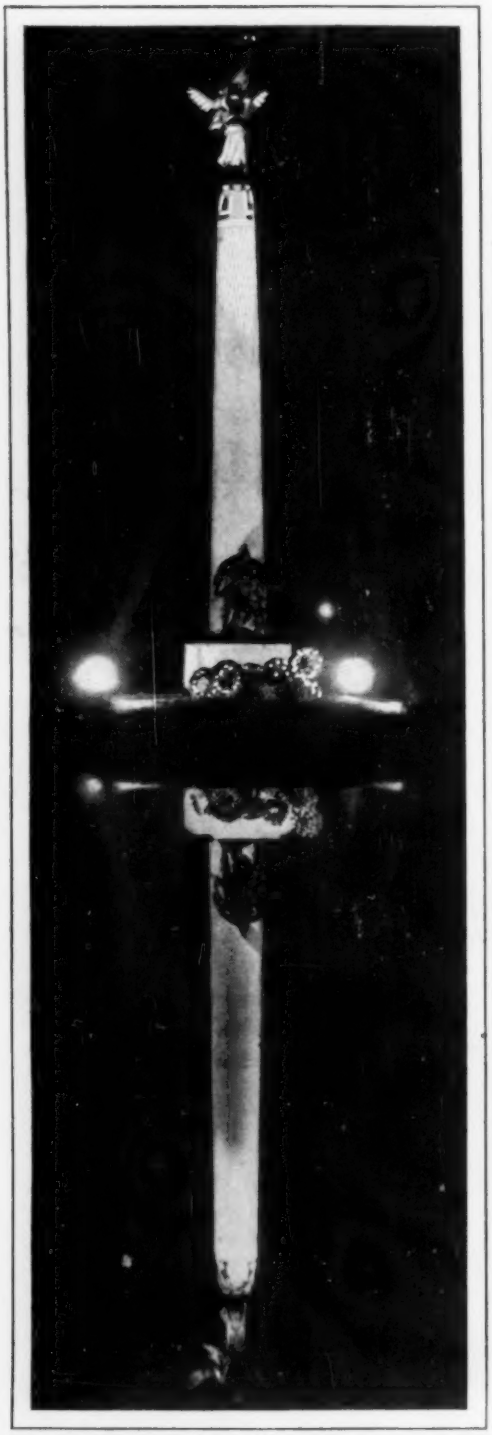


How Lights Lend Beauty to Smokestacks, and Close View of Floodlight Battery; Correctly Placing the Lamps Requires Considerable Skill

At Left, the Beautifully Floodlighted Top of the New York City Hall, and, at Right, a Skyscraper Tinted with Well-Directed Rays to Reveal Its Lines and the Set-Backs on the Upper Floors; These Set-Backs and Shelves Form Convenient Places for the Location of Batteries of Floodlights and the Use of Different Colors

Modern Lighting Adds to the Beauty of Classic Architecture; the Lincoln Memorial in Washington, D. C., as It Appears at Night

© Horydzak



Floodlighted Memorial Column and Its Beautiful Night-Time Reflection in a Quiet Pool; Such Lighting Is Also Helpful to Aviators

while the white light is connected to dimmers and is dimmed off and on. For example, if we blend red and white, we get all shades from red to light pink tints. In this way, the floodlighting engineer achieves both motion and color."

Mr. Paulus touched upon the possibility of floodlighting ocean liners at sea. A start in this direction was made by the "Bremen" and "Europa" with giant electric signs advertising their identity to other ships passing in the night. But with keener competition for public notice, it is not unforeseen that crack passenger vessels will take to floodlighting parts of the ship whose illumination will not interfere with navigation.

America has done little with the floodlighting of bridges, but this, too, is a coming field. When more decorative bridges are built, like the new Arlington bridge at Washington, attention will naturally be turned on their illumination. On a stone-arch bridge of this type, the effect of colored lights over water will be nothing short of gorgeous.

Swimming pools are now being equipped with underwater floodlighting units that add not only to beauty but to safety as well. Every person under water will be visible. Instead of having brilliant glaring lights hang from the ceiling of an indoor pool, it is the present fashion to have the exterior illumination as dim as possible in order to accentuate the white brilliancy of the pool's tile.

In floodlighting fountains and water bodies, engineers have found that the effect is unpleasant if the illumination is over an even surface. If a cataract falls smoothly, without ripples, over the crest, the effect is flat. At Barcelona, engineers punched tiny holes in pipes and placed them across the waterfalls. Tiny jets of water burst through the holes and caused the water stream to be very uneven. The play of light beams on this rough surface gave a startling iridescence which was enhanced by the play of different light tints. The same applies to a fountain; if there is no break at the crest, it looks dull. The more spray and flying drops, the more beautiful the effect.

¶Wood veneers as thin as paper now are being made on a commercial scale.

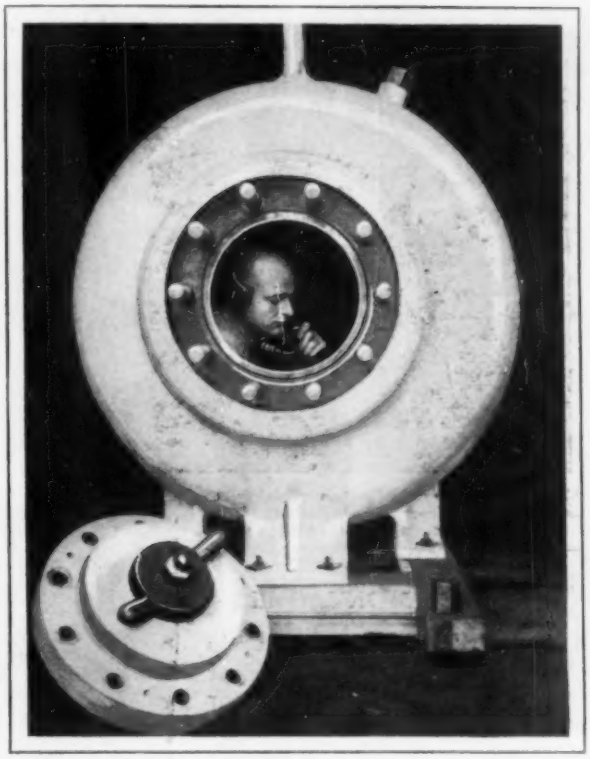
MAKING POPCORN POP

If popcorn contains less than thirteen or more than fourteen per cent of moisture, its popping qualities are materially lessened, and two professors of the University of Wisconsin have made a drying bin to give it maximum popping value. Dry air is driven by motor into the space for the corn, and regardless of the corn's original moisture content, the quick drying gives it the maximum popping value because it reduces the content to the required percentage and no lower. The process has been found of value also in curing sweet corn, which has been difficult to handle because of its tendency to settle in a solid mass when piled in a bin as is ordinarily done.

AUTOISTS DO BANKING FROM THEIR CARS

Patrons of the Grand National bank in St. Louis may drive up to the building and transact business, without leaving their automobiles, through a window built close to the curb. When the clerk is not on duty, deposits may be made through a thief-proof slot at one side of the window.

Bank Window Close to Curb, Where Motorists May Make Deposits without Leaving Their Cars



Diving Bell for Deep-Sea Exploration; It Is Fitted with Quartz-Glass "Eyes" for Observers and Camera Operation

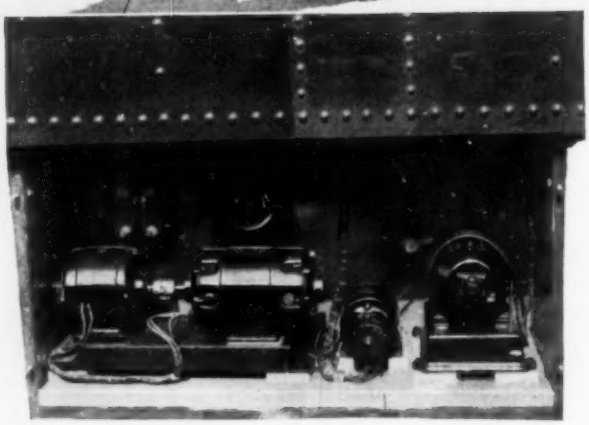
DIVING BELL WITH GLASS EYES TO EXPLORE OCEAN DEPTHS

To make observations of the sea bed at great depths, a special diving bell is being constructed at the Museum of Natural History in New York for the use of New York zoological station in Bermuda. Three "eyes" in one end of the vessel are fitted with quartz glass, three inches thick, to provide for light and camera operation.

BARK OF TREE RESISTS FIRE

The bark of the California big tree is, on large specimens, as much as three feet thick and almost as fire-resistant as asbestos. A piece of it, a foot square, was only charred on the outside after having been placed in a lumber-mill furnace, surrounded by dry pine and burned for eight hours. This quality is one reason for longevity of the big trees, which are known to have attained an age of 4,000 years, and may reach 6,000 years or more.

THE WORLD'S FIRST TWO-WAY TRAIN TELEPHONE



Above, Sir Henry Thornton Talking to London from Moving Train, While J. C. Burkholder Operates Switchboard; Right and Below, Connecting Transmitting Antenna and Generator on Car

By JAMES MONTAGNES

WE WERE chatting away in our comfortable parlor-car seats on the sixty-mile-per-hour express operating between Toronto and Montreal, when a uniformed young man came up to my companion and said:

"You are wanted on the telephone, sir."

Five minutes later my traveling companion came back, his face all smiles. "I was just talking to my wife and two kids back home in Cleveland. You see," he explained to me, seating himself, "when I heard that there was a telephone service on this train, I decided to try it, and so arranged to have a call put through to Cleveland."

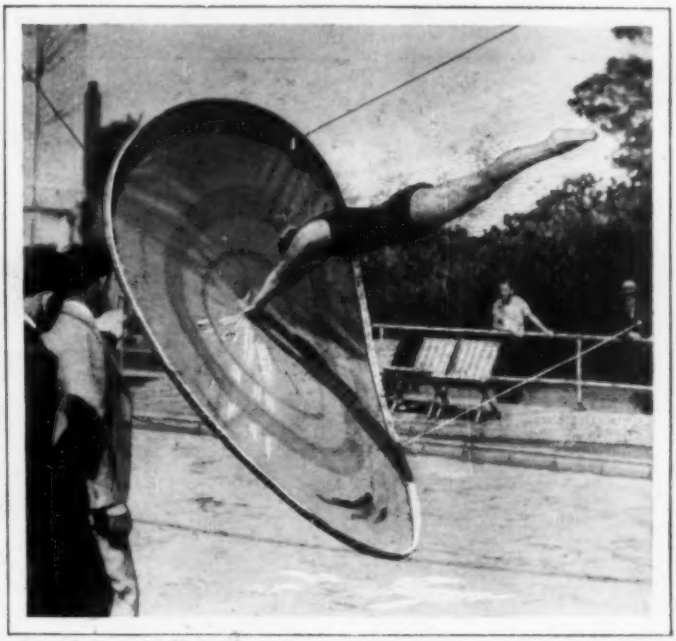
I asked him how it sounded, and he replied that his talk with his wife and youngsters was just like putting in a call from downtown Cleveland. In fact, his wife, he remarked, would not believe that he was on a train moving away from her at a mile a minute. The conversation was as clear as on any telephone call, and in addition there was no noise from the moving train because the telephone booth had been padded and soundproofed.

It seems somehow unnatural that one should be able to talk to someone hundreds of miles distant while moving at a great rate of speed. But to the passengers who board the International Limited of the Canadian National railways, plying between the cities of Montreal and Toronto, the service is a reality.

The world's first two-way telephone service operates on a combination of radio circuits. From a seven-wire antenna on the roof of the steel car the messages go out and are received. The middle three wires are for transmission, while reception is effected on the four outside wires of the seven. When a telephone message starts in the ordinary telephone microphone used, it sends out radio waves which jump from the antenna on the roof of the speeding car to telegraph wires alongside the track. These wires, which pick up the radio telephone signals, are known as carrier-current wires, in that each wire is capable, by means of radio instruments at the terminal stations, to handle some twenty messages at the same

time, differing from the ordinary telegraph wires. The carrier-current system allows the use of voice transmission, giving a perfect voice reproduction at the receiving end. When the telephone message strikes the carrier-current wires, it is carried along to the terminal station, where it is placed on the telephone lines to the point of destination, just as in a long-distance call.

The reception of a telephone message on the train is accomplished in the same manner, the transmission this time going from the terminal station to the carrier-current lines, preceded by an automatic calling device which tells the train operator that a call is coming through. From the carrier-current lines, the radio telephone message skips to the train antenna and is changed into voice by the train receiving set. All this occurs simultaneously, there being no delay whatever in train-telephone conversation.



Paper-Covered Hoop in Position above a Swimming Pool Forms the Target for This Human Arrow in the Latest Water Sport

DIVER BECOMES HUMAN ARROW IN LEAP THROUGH HOOP

Human arrows shoot themselves at paper-covered targets in the latest swimming sport, introduced recently in Los Angeles. Huge hoops, covered with paper, are the targets, which are placed in position above a swimming pool. The divers vie for perfect bull's-eye scores by aiming at the center as they hurtle toward the water from the diving board.

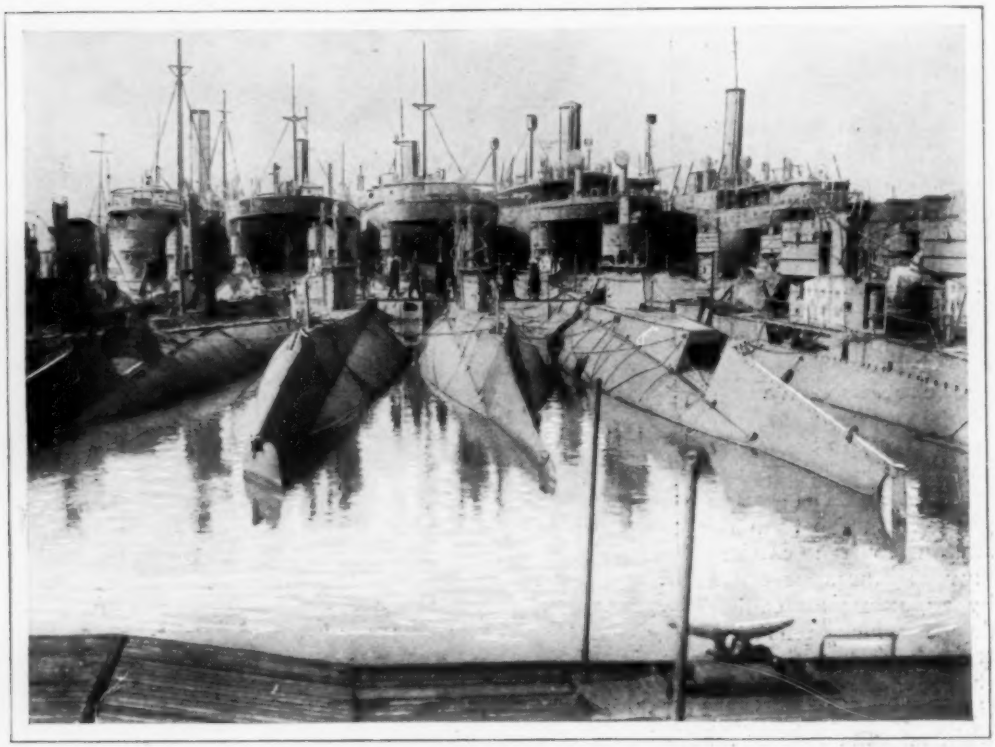
LADY BEETLES RAISED TO WAR ON CITRUS SCOURGE

Millions of lady beetles are bred annually in California to combat the ravages of the mealy bug among the citrus growths. The beetles are reared in tiny capsules, ten to a capsule, and turned loose in the fields upon reaching adolescence. They are propagated on a mealy-bug diet and sold to the farmers for half a cent each, the cost of production. Each year an estimate of the number of mealy bugs is made to determine the number of beetles necessary to fight them.

VEST-POCKET SAFETY RAZOR IS CARRIED IN OWN HANDLE

Flattened handles of vest-pocket safety razors provide carrying cases for both the razor blades and the blade holders. A small cover at the end of the handle locks blades and holder securely, and the entire outfit does not bulge the pocket. The razor is used with ordinary thin blades.

NAVAL JUNK PILE RECEIVES THIRTEEN "SUBS"



Some of the Thirteen United States Submarines Which Are Destined for the Scrap Pile under Naval Limitations Agreement; the Picture Shows the Boats in the Philadelphia Navy Yard

Thirteen submarines destined ultimately for the junk pile now rest in the Philadelphia navy yard. The underseas craft to be scrapped were built in 1917, and under the naval-limitations agreement, thirteen years is the age limit for the boats, so this year means their end.

AN AMPLIFIER FOR THE VIOLIN

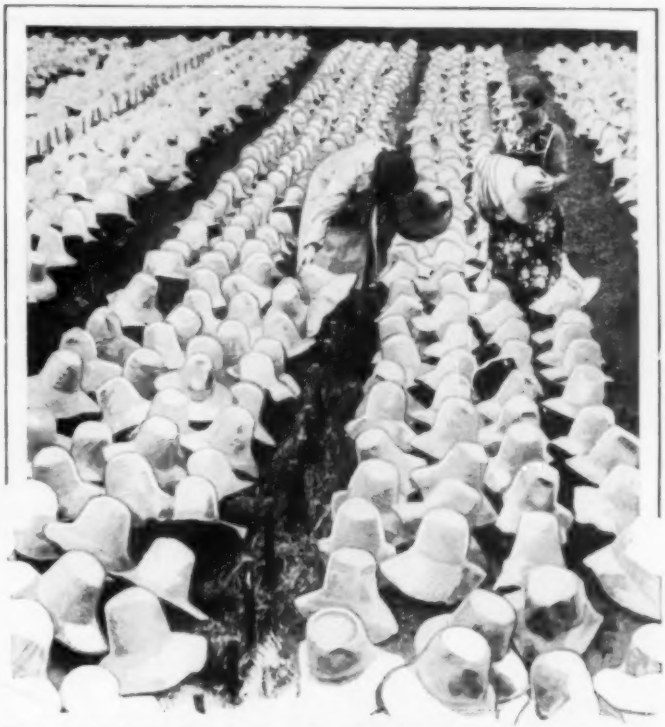
To increase the tone volume of a violin, cello or viola, an amplifier recently was demonstrated with success in Paris. The violin used with the amplifier resembles the ordinary instrument, except that there are no openings in the sounding board. It is connected by a wire with a diaphragm inclosed in a sounding box like a phonograph. When the bow is applied to the strings their vibrations are transformed into electromagnetic waves which pass through a series of transformers, and are amplified by the diaphragm to produce the louder tones. Tests show that the tones soar above the background of strings and brass of the full orchestra.

ILLUMINATED READING GLASS FOCUSED AUTOMATICALLY

Troubles with focusing and illumination, encountered with the old type of reading and magnifying glass, are overcome with a reading glass contained in a cabinet in which is an electric light. The glass focuses automatically when placed on the page, and the light may be plugged into any wall outlet to provide plenty of illumination for the object being examined, while at the same time shielding the eyes from the direct rays.

FISH HAVE GOOD HEARING

Fish have a sense of hearing so keen that they can perceive vibrations too low for the human ear, and are able to hear sounds a little beyond the highest notes of a piano or violin. Dr. Karl von Frisch, of the University of Munich, experimenting with minnows, found that they soon learned to answer the dinner whistle. He offered them food, at the same time sounding a tuning fork or blowing a whistle. They came to know that the sound meant dinner, and soon came crowding to the feeding place when they heard it. By feeding to the accompaniment of one note, and scaring them away with a tap of a glass rod when another was sounded, the minnows learned to distinguish between sounds. No tuning-fork vibration rate was found that the fish could not hear. Some experiments indicated they may have two sets of organs for detecting sound.



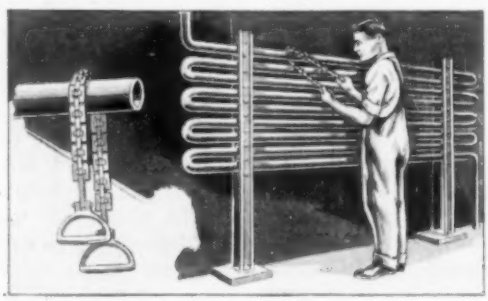
Hundreds of Straw Hats Piled on the Bleaching Pegs in Front of a Large Factory in Luton, England

BLEACH STRAW HATS OUTDOORS AT ENGLISH FACTORY

Although chemical methods are now largely employed in the bleaching of straw for hats, the sun is an important aid at a factory in Luton, England. Hundreds of hats are placed at a time on short pegs outside the works, where they are bleached and dried before the final steps of manufacture. Hat making has been an important industry in this city for many years. During the days of King James I, a colony of straw plaiters was imported from Scotland, and their craft has been carried on until the making of straw goods has become one of the chief activities of the city.

CLEANER FOR CONDENSER PIPES REMOVES SCALE EASILY

Removing scale from the outside of boiler tubes, brine coils or oil-well casings, preparatory to painting, is easily performed with a steel-link chain cleaner. It consists of a length of steel links with a handle at each end. The links are equipped with two cutters each, which are easily sharpened by grinding. Cutters may be replaced, and the tool can be obtained in sizes for two, four and six-inch pipes.



Link-Chain Cleaner for Condenser Pipes; the Links Are Equipped with Steel Cutting Blades

¶A twenty-inch snow represents only about two inches of water.

Just How "GOOD"

Anybody Can Become a Good Pistol Shot, Says Doctor Calkins, and in This Article He Tells How

By I. R. CALKINS, M. D.

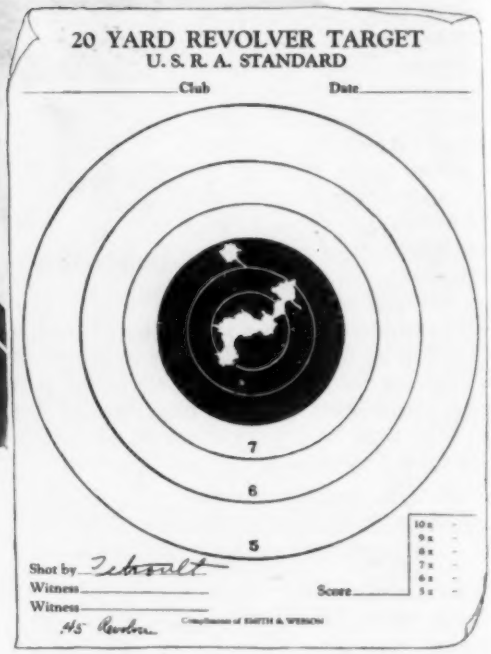
National and International Target Pistol Champion
(As Told to John F. Coggswell)

NOT long ago, a westerner, famous for his handling of the frontier-model .45-caliber six-shooter, appeared at the indoor range of the Springfield, Mass., club of the United States revolver association.

The fame of this man was national and we gathered to see some fancy stuff with the big hand-arm that held favor when the west was wild and the six-gun was the law. We talked of big and small guns, of slow fire and quick draws, of old-time killers and modern gunmen—good and bad—of "rolling" and "fanning" guns.

"Out in our part of the country," observed the western expert, "we fan the gun when we want to get our shots off fast."

There wasn't a single man present who had ever seen an expert fan a gun, so we immediately called for a demonstration. Gun fanning is a two-handed shooting proposition. The gun is held and aimed in the right hand, with the trigger squeezed back. Then the gun is fired by slapping the heel of the left hand against the cocking piece of the hammer, lifting the hammer and allowing it to drop against the firing pin and discharge the shell. According to stories of the old west, this was the fastest and most deadly method of discharging a revolver.



The westerner was willing to oblige. We hung up a twenty-two-inch target and the marksman took his stand at a distance of twenty-five feet. He got off his six shots in exactly nine seconds after the

Were the BAD MEN?

Few of the "Two-Gun" Desperadoes of Frontier Days Could Really Shoot as Accurately as Legends Tell

command to fire. None of the bullets hit the black center of the target. Two were in the white. The other four were in the sides and roof of the covered range.

"Is that as good a score as the old-time fanners used to make?" asked a police officer.

"Just about," the westerner assured him. "Fanning isn't as accurate as slow fire, but it's so almighty fast that it got the other fellow first in the old days."

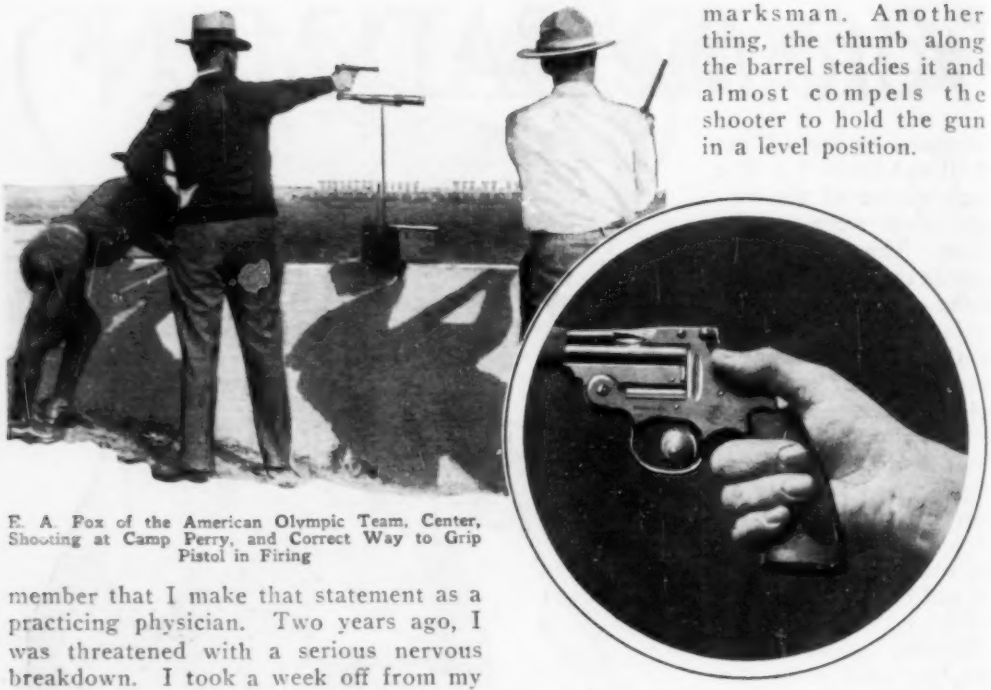
Without comment, the policeman reloaded the gun, replaced it in the holster and took his stand at a distance of forty feet from the target, five paces back from where the fanner had stood. At the word to fire, his hand swept the gun from the holster and slowly brought it up to firing position. So deliberate were his movements, that they appeared slow beside the fanning demonstration.

Even as the first shot rang out, his gun rolled to the side, his thumb found the hammer and cocked it and the .45 swung onto the target again. He got his shots away fast. In fact, the stop watch clicked for the last shot just five and one-half seconds after the command to fire had been given. Five of the officer's bullets were in the black, the sixth was just out of it.

This incident is not cited in disparagement of the western man's ability as a marksman. In fact, there are few men in the world who can outshoot him with the .45—when he doesn't try fancy shooting. But it does bring out the point I wish to make: Trick shooting never could compete with plain, everyday gunwork in puting bullets into the target. And, after all, that's the main idea in firing a gun.

Furthermore, that police officer had taken up hand-gun shooting in earnest but nine months before his encounter with the westerner, which spells encouragement for the novice. Really, accurate shooting with pistol or revolver is no complicated proposition. There are just two things that the novice must master to be well on the road to efficient marksmanship.

Anybody can become a good pistol shot. All there is to learn is to hold and squeeze, that is, to hold the sights on the target and squeeze the trigger without disturbing the aim. Hand-gun shooting is a fascinating sport—and more. It's the greatest nerve tonic that I know of—and re-



E. A. Fox of the American Olympic Team, Center, Shooting at Camp Perry, and Correct Way to Grip Pistol in Firing

member that I make that statement as a practicing physician. Two years ago, I was threatened with a serious nervous breakdown. I took a week off from my practice and went down to the range and actually shot the nerves out of myself. I know of nothing else that will snap a man out of nervous trouble as quickly as will target practice. He has to concentrate on his shots with every faculty he possesses. In this concentration, he forgets not only himself but everything about him save only the job in hand.

I advise the novice to start in with a single-shot .22-caliber target pistol. This arm is the most accurate of any made. The recoil is very slight and the charge not heavy enough to cause flinching on the part of the embryo shooter. Besides, it is inexpensive. At first, the novice should practice with an empty gun. Do not clutch the grip tightly. Let it rest loosely between the fingers and the palm, with the thumb pointed straight along the barrel. Place the first finger of the shooting hand through the trigger guard, letting the weight of the gun be taken by the other fingers and the palm.

The position of the thumb is most important. Without a gun, try pointing the thumb at any near-by object. You will find that you can snap the point of that digit onto the mark with great accuracy. Aim with your thumb; it will make you a marksman. Another thing, the thumb along the barrel steadies it and almost compels the shooter to hold the gun in a level position.

Right from the start you should make yourself aim with both eyes open. It is easy after a little practice. Every really good marksman that I know of shoots with both eyes open. Now, hold the pistol in the right hand, at an angle of about forty-five degrees from the body, with the weapon pointing toward the floor and the arm just as straight as you can hold it without conscious effort. Let your full weight fall upon the heels and relax. Relax every muscle in your body except those of the right shoulder. Pretend that these are the only muscles over which you have any control. Practice attaining this relaxed position a while before raising the pistol any higher.

Slowly bring up the gun toward the horizontal position, using the shoulder muscles only. At the very start of the movement, slip your thumb to the hammer and cock it and then return the thumb to the position alongside the barrel. Let your raising of the pistol be slow and deliberate. Keep both eyes open and on the bull's-eye. As you raise the gun, start squeezing the trigger little by little.

The average pistol trigger has a pull of three pounds. You will find that, with some practice, you will be able to have all

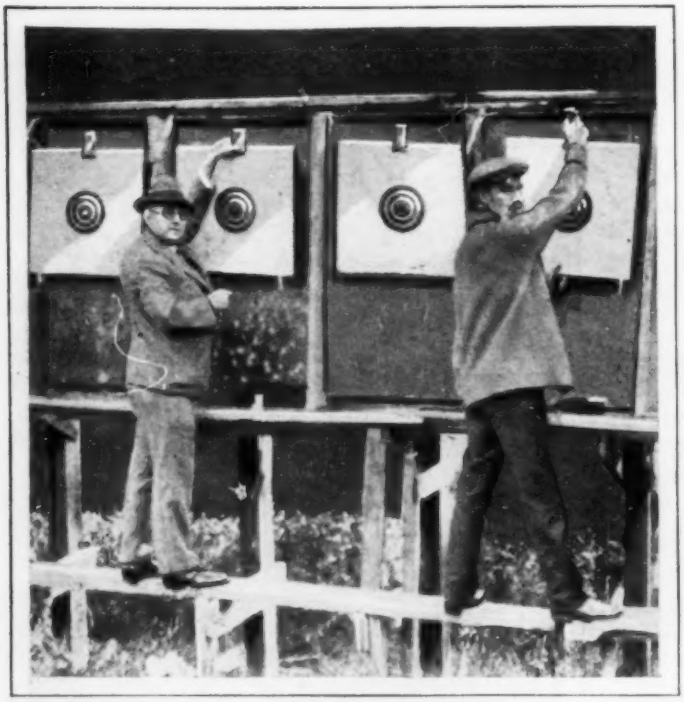
but a few ounces of the squeeze exerted by the time your arm reaches firing position. As soon as the sights line up on the bottom of the bull's-eye, exert the few ounces more squeeze necessary to make the hammer fall.

Practice this many times before you load your pistol. You will soon find that you can line your sights on the bull and hold them there. In short, you have learned to hold. If you have been exerting a gradually stronger pressure on the trigger from the time you start raising the gun, instead of giving it a quick pull when the sights line up, you have also learned to squeeze. And that's the whole thing—hold and squeeze. After you have become the master of the single-shot pistol, you will find that the transition to the revolver is easy. Then you'll have to learn to roll your gun between shots.

It is well-nigh impossible to keep the revolver sighted on the bull's-eye while cocking it preparatory to sending a shot quickly after another, whether the cocking be done by the thumb or by the double-action or self-cocking arrangement with which all modern revolvers are equipped. So, the expert makes no effort to keep the gun pointed at the target between shots. Instead, he deliberately rolls the muzzle away from the bull's-eye during the cocking operation. But his extended shooting arm remains pointed rigidly toward the mark, the roll being accomplished by the wrist and fingers only.

The recoil of the powder charge tends to throw the muzzle upward. This upward movement is followed and assisted by the wrist, which also throws the barrel sideways to the right, so that the front sight describes the arc of a circle. At the top of the roll, the thumb finds the hammer. Immediately, the three fingers on the grip start drawing the muzzle

Top to Bottom, Correct Positions in Firing: Ready; Raising the Pistol; on the Mark, and "Rolling" the Gun with the Recoil after Firing



Pistol Ranges Are Not Costly; This One Has a Simple Wooden Frame and Metal Sheets for Targets

back toward the target. This action causes the hammer to press against the thumb and cocks the weapon automatically as the sights swing toward the bull's-eye. As soon as the hammer arrives at full cock, the thumb is slipped back to its position parallel to the barrel, and the marksman is ready for his next shot.

Probably the biggest thrill that a novice marksman gets in target shooting comes when he realizes that he has caught on to how to roll his gun.

SHIP-TO-SHORE PHONE CALLS REQUIRE MANY HANDS

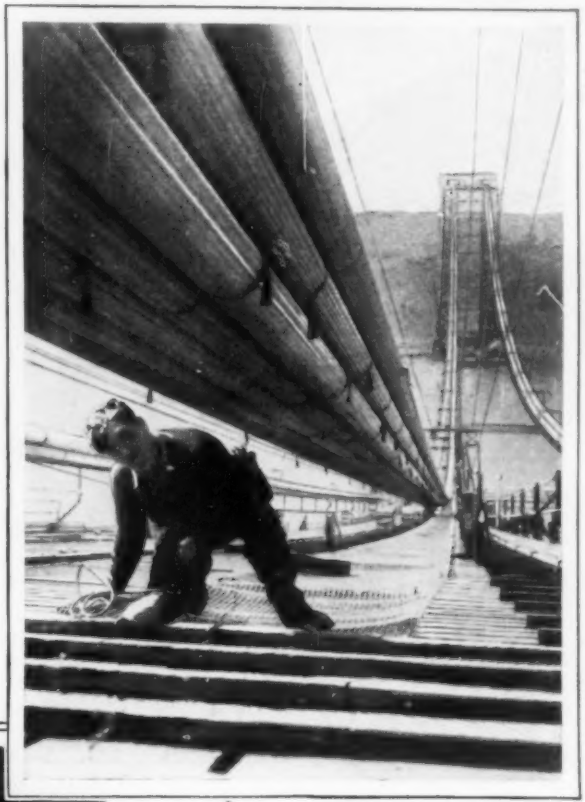
Two-way telephone conversations between a steamer such as the "Leviathan" and persons on shore, require sensitive and complicated radio apparatus and a number of persons to make the necessary connections. About all the passenger on the vessel sees is an ordinary telephone transmitter, but behind it are the receiving and transmission sets, the latter in a room of the radio cabin and the former on the port side of the wireless rooms. For transmitting, a motor generator is inclosed in paneling, covered on the inner side by sound-absorbing material and on the outer with grounded copper sheet, the apparatus being cooled by a stream of air from a blower. Two stations on shore form the connecting link between the ship and the telephones throughout the land. Messages coming from the vessel are picked up at a receiving station at Fork River, N. J., and thence are dispatched over telephone wires. Replies from persons on shore are transmitted to the ship through another station at Deal Beach, N. J. Ship-to-shore telephony is accomplished in the same general way as any radio telephoning, but special problems have to be solved. In the first place, the ship is moving, the space for the apparatus is exceedingly limited, and the steel ship, its vibrations, and other electrical equipment, offer sources of interference that had to be overcome.

AIR-PUMP PISTOL ON OILCAN SHOOTS TEN-FOOT STREAM

Easily attached to the top of a can of lubricating oil, an air-pump pistol can be operated with only one hand and shoots a fine stream of lubricating oil for ten or twelve feet. Four or five strokes of the air pump in the top of the can and a pressure on the trigger set the gun into action. It shoots from all angles and positions and has been found particularly useful for lubricating auto springs and squeaking parts of the car body.

ITALY BUILDING FAST LINERS FOR ATLANTIC SPEED RACE

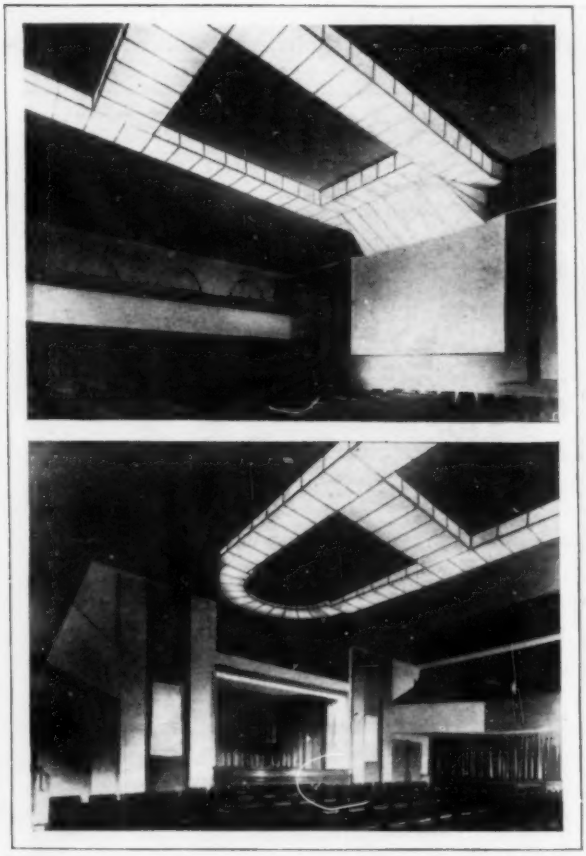
Italy has decided to support her prestige at sea by the construction of two huge express liners for the Atlantic service of the Lloyd Sabaudo. They are intended to make the run between Naples and New York in seven days, of which five is the time between Gibraltar and New York. One of them is to be called the "Rex." It will have a speed of about twenty-seven knots and will be equipped with high-pressure turbines. The decision to build these costly ships is all the more remarkable since the number of Italian emigrants to America is being further restricted.



BRIDGE WIRE AS LONG AS HALFWAY TO MOON

Four cables of the world's largest suspension bridge spanning the Hudson river in New York will contain, when completed, 107,000 miles of wire, enough to circle the world four times at the equator or reach nearly halfway to the moon. Although this wire is only the size of a lead pencil it can support a load of 7,600 pounds or the pull of ten draft horses. Sixty-one giant strands, each composed of 434 wires, will be required to complete each cable. Four deeply grooved pulleys or sheaves constantly pass from the New Jersey to the Manhattan anchorages on an endless rope, unwinding the wire, which comes in thirty-mile lengths on reels six feet in diameter. On each trip the pulleys bring one wire to be added to the strand. This part of the work is half finished.

Above, Some of the Cables Supporting the Hudson River Suspension Bridge; Below, Shuttle Pulleys Unwinding Miles of Wire for the Cables



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Movie Screen and Lecture Platform at Opposite Ends of Church Community House Containing Reversible Seats

REVERSIBLE SEATS TURN MOVIE INTO LECTURE HALL

Making the same edifice available for both lectures and moving pictures, a church community house in Berlin has been equipped with reversible seats. The backs of the seats may be turned so the occupants face either end of the auditorium. At one end is the lecture platform, and at the other the screen for the pictures.

AVIATORS AVOID BAD WEATHER AT SIX-MILE ALTITUDE

Aviators can avoid all forms of bad weather by ascending to an altitude of 30,000 feet, or nearly six miles, the weather bureau has found. Col. Charles Lindbergh, in his recent transcontinental flight of less than fifteen hours, flew at altitudes of from 10,000 to 20,000 feet, and even at this height avoided most of the weather dangers that beset aerial navigation. Most of the rain and snow falls from lower altitudes, and only exceptional thunderstorms reach that height. Winds three miles high over the United States blow from the Pacific to the Atlantic at about thirty or forty miles an hour throughout the year. They vary somewhat over the states along the Gulf of Mexico, changing direction in summer and fall. Temperatures at 15,000 feet are usually more than 50 degrees lower than on the earth beneath, aviators finding freezing weather even in the summer. At heights of 30,000 feet, where there is no bad weather whatever, oxygen-breathing apparatus is required.

HAND AND BENCH SAW ARE COMBINED BY ATTACHMENT

In less than a minute, a power saw may be converted from the portable hand type to bench use by employing a simple table attachment which requires only the removal of a thumbscrew to make the change. The swivel base on which the saw arm swings turns in a full circle and contains a graduated scale so that, when the saw is used for table work, the correct angle can be quickly obtained, and also in bench work.

Attachment for Electric Handsaw, Which Converts It into the Bench Type in a Few Seconds

Part of Gigantic Relief Map of United States, Which, When Completed, Will Be Forty-Six Feet Wide; It Is Curved to Represent the Earth's Contour, and May Be of Aid to Aviators

MONSTER RELIEF MAP CURVED TO SHAPE OF WORLD

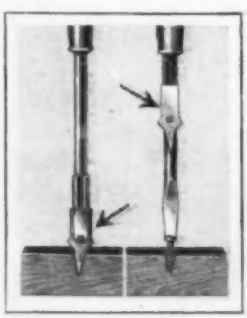
Planned on a scale providing a width of forty-six feet between the Atlantic and Pacific oceans, a huge relief map of the United States is being constructed at the Babson institute, at Wellesley, Mass. The gigantic map, which is curved to represent the earth's surface, is expected to be of great help to aviators in planning routes, as a glance will show mountain peaks and elevations of the terrain.

LIGHTS STOP FROGS' CROAKING

When guests of a California hotel complained that croaking frogs in near-by lily ponds disturbed their slumbers, the management stocked the ponds with ducks, offered prizes to children for capturing frogs and employed rifle shooters to rid the waters of the noise makers, all without avail. Finally, learning that frogs sing only under cover of darkness, the hotel owners illuminated the ponds at night by electric floodlights. Now the frogs sit mute, expectantly awaiting the coming of a darkness that never appears, and the guests sleep in peace.

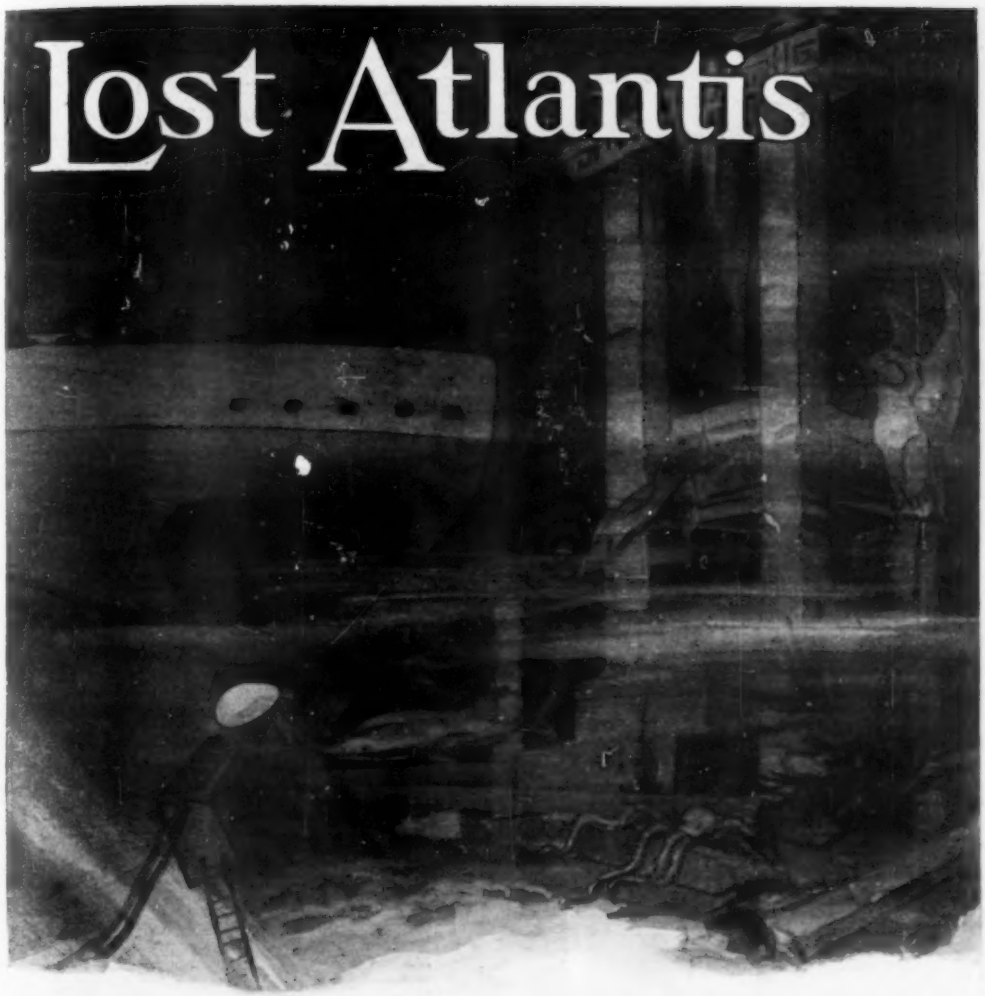
AWL FOR SCREWDRIVER BLADE MAKES DOUBLE-DUTY TOOL

Any ordinary screwdriver can be transformed into an awl in an instant with an attachment which fits on the driver blade to make a hole for starting the screw. The awl locks in position over the edge of the blade when in use, and when the screwdriver is employed in the regular way, it slides up against the handle. Drilling a hole to start a screw with the awl takes but a few seconds, and it is then snapped out of the way.



The Hunt for

Lost Atlantis



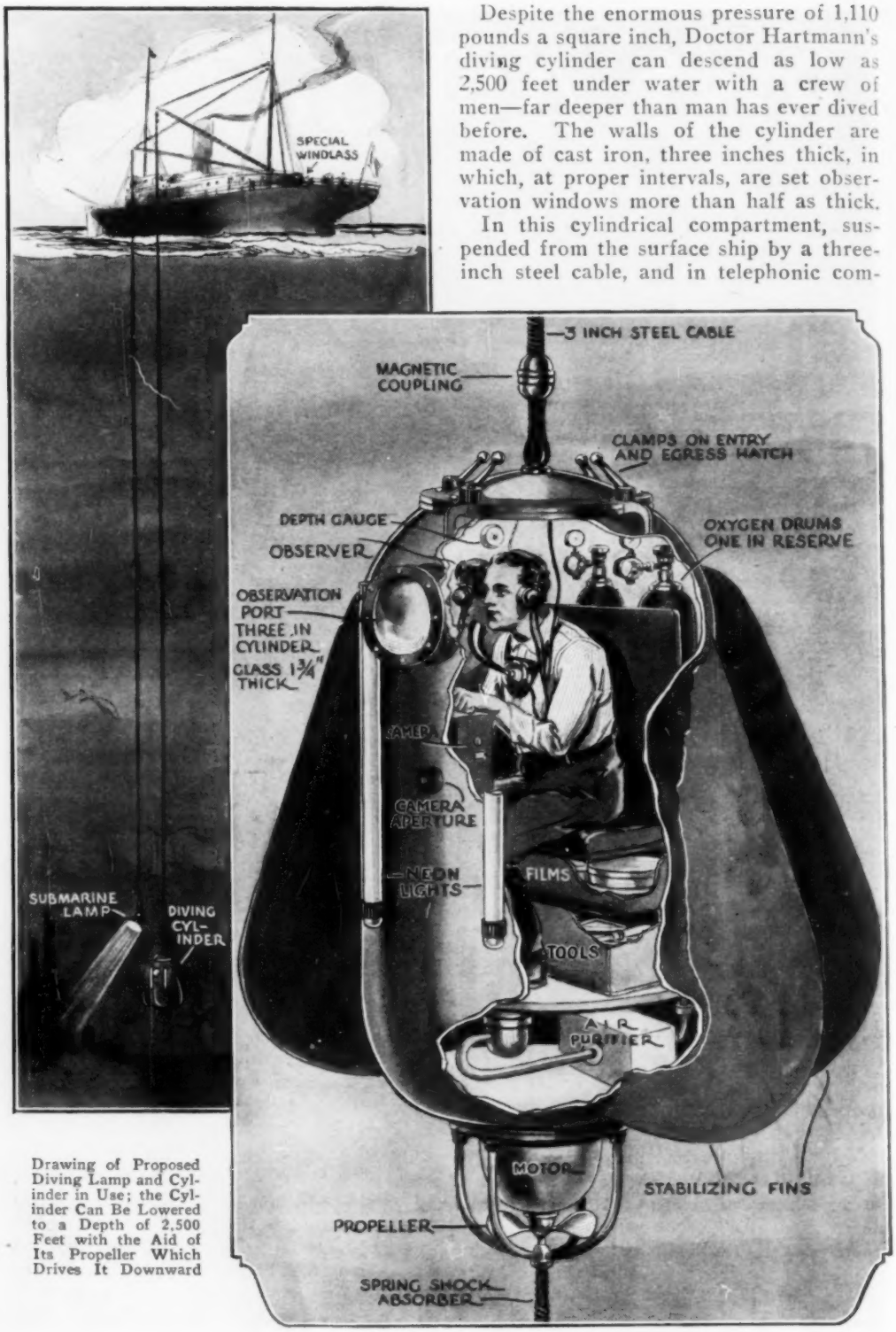
Artist's Drawing of Scene That May Become a Reality; Divers with Special Submarine Lights, Exploring the Ruins of the Fabled Atlantis, Search for Which Is to Be Renewed

By LESLIE OREAR

AT THE bottom of the Atlantic ocean, stretching westward from the Mediterranean and the northern part of Africa, lies, perhaps, the lost continent of Atlantis which, some think, once connected Africa with South America.

Within the near future, an undersea expedition is planned that should go far toward proving whether there existed, more than 50,000 years ago, a continent of rich and fabulous cities where dwelt the legendary race of Amazons, descendants of whom, it is believed, still may be found in the mountain fastnesses of the Sahara, and traces of whom have been found in Yucatan.

Already there have been wrested from the sea the secrets of several ancient cities that were submerged by some unrecorded catastrophe, and what those discoveries have revealed inspired Count Byron Kuhn de Prorok, famed archæologist, to organize, in collaboration with French and American institutions, this new expedition in search of the lost Atlantis. Associated with Count de Prorok is Dr. H. Hartmann, whose new diving cylinder makes the success of this venture a probability.



Drawing of Proposed Diving Lamp and Cylinder in Use; the Cylinder Can Be Lowered to a Depth of 2,500 Feet with the Aid of Its Propeller Which Drives It Downward

Despite the enormous pressure of 1,110 pounds a square inch, Doctor Hartmann's diving cylinder can descend as low as 2,500 feet under water with a crew of men—far deeper than man has ever dived before. The walls of the cylinder are made of cast iron, three inches thick, in which, at proper intervals, are set observation windows more than half as thick.

In this cylindrical compartment, suspended from the surface ship by a three-inch steel cable, and in telephonic com-

munication with the surface crew, will be two men, one observing whatever may be revealed in the light of specially designed neon lamps and the other operating a motion-picture camera. A supply of oxygen, released from two drums within the cylinder, will enable the observers to remain below water for three-quarters of an hour.

And so, equipped as no undersea expedition ever before has been outfitted, this expedition of the Deep Sea Archæological Research society will set out to find—what? Sunken cities; kings' palaces; slaves' huts; the sea-drenched remains of the long lost life of a people who lived and loved and fought and hated centuries before the birth of Christ?

But let Count de Prorok tell it.

"The ancient history of the Mediterranean tells us of cities that have been submerged, galleys that have sunk, and other treasures beneath the sea. And the legend of the lost continent is still the subject of endless controversy. I long have thrilled at the thought that the legend of Atlantis might be an existing fact; of a submerged continent between the Americas and Africa, where ruins of a lost civilization may still be found with

The Count de Prorok Deep-Sea Expedition in Search of Lost Atlantis 1927-29, and the Count on a Camel during a Sahara Journey

In the Sahara Desert Where an Unknown Script, Possibly a Clue to Atlantis, Was Discovered, and the Count Meeting Desert Dignitaries

temples and houses covered with the sea growth of ages to be explored and excavated by the new diving apparatus of modern invention," said he in discussing his plans for the forthcoming expedition.

But foremost in Count de Prorok's mind lies the hope, which is really more than hope, that he will be able to prove that Africa and South America once were connected by land. The evidence of the skeletons points to the existence of prehistoric men of great intelligence and stature who originated in northern Africa and crossed into Europe over what the count believes were once great land bridges at Gibraltar, Tunis, Sicily, and other points, parts of which are now submerged.

It has been found that detailed measurements of the skulls of Gauchi peoples of the Madeira islands compare exactly with those of present day Tauregs of the Sahara and with certain skulls found in tombs in Yucatan. How, long before the dawn of history, did counterparts of the unusual Taureg find their way into Yucatan?

Coincident with the subterranean exploration there will be a land expedition deep into the northern part of Africa to determine just to what extent human life moved through the Hoggar and Atlas mountains, where, it is believed, the original home of the Atlanteans may have been. Skeletons identical with living Tauregs have been found there. Over the Sahara desert an expedition will go with powerful six-wheel trucks capable of traveling 800 miles without refueling; equipped with searchlights for night work, labora-

tory facilities and machine guns for protection against the ferocity of the Tauregs —surly giants; remnants of a vast civilization, the last of the Atlanteans.

Both the land and sea expeditions go equipped with every known modern device that might lend itself to the success of the enterprise. Always hovering above the diving cylinder will be a 140-foot yacht. In addition to a laboratory, it will contain special grappling apparatus, wireless equipment, photographic installations, a glass bottom for submarine observation and the great windlass for manipulating the diving cylinder. It also will carry an unusual type of submarine boat from which divers may emerge into a lost world of ruins of cities, or explore the sunken treasures of ancient Carthaginian galleys.

An airplane, equipped with the latest talking-picture apparatus, will fly above both land and sea expeditions. Indeed, it was the discovery of objects beneath the sea from an airplane that gave the impetus to this forthcoming expedition. For long centuries, unsuspected, the walls of Carthage lay covered by the Mediterranean sea. And then an airplane of Count de Prorok's expedition, flying at a height of 1,000 feet, enabled the observer clearly to trace their outline and establish the fact that a part of the ancient capital of the world had slipped into the sea. In the same way the lost city of Tipasa was discovered seventy feet under the water.

"From the Atlantic to the Red Sea," says Count de Prorok, "north Africa is an open-air museum unequaled in the world. The great ones of the past seem to haunt the desert trails, and often by some lone camp fire we have evoked the mighty shadows that have thundered by, disappearing into the dim mists of history. Hannibal, Alexander the Great, Cleopatra, Scipio Africanus, Cæsar—those magic names alone have made a treasure house of memories in ancient Sahara lands.

"And now to search the sea itself for those things which are beyond history—stories told from father to son for unnumbered generations; the land of legends. We embark upon this romantic quest confident that we shall give to the world some insight into the most ancient civilizations of all time—the lost Atlanteans."

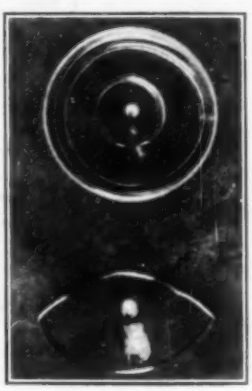
FLEXIBLE SHAFT ON GOLF CLUB GIVES LONGER DRIVE

As a boon to long-distance drivers, a golf club with a flexible shaft has made its appearance on Florida courses. The flexibility of the shaft was found to lend more power to the swing, thus making longer drives possible. Except that the shaft bends slightly when force is applied, the club resembles the ordinary driver.

Golf Clubs with Flexible Shafts Which Lend More Power to Swings for Long Shots

GLASS DISKS UNDER EYELIDS REPLACE SPECTACLES

Disks that fit snugly over the cornea of the eye and are worn under the eyelids have been made and tested successfully as a substitute for spectacles. Their principal advantage is that they are virtually invisible to any other person. They can be placed in position readily by the wearer, and need no adjustment when once fitted to the eye, except periodical removal for cleaning.



Spectacles with Upper Part of Lenses Shaded, to Protect Eyes against Brilliant Light

SHADED LENS FOR SPECTACLES SHUTS OUT GLARE

Varying intensities of shading are available in a special spectacle lens which can be ground to any prescription. The upper portion of the lens is darkest, the bottom being almost the shade of transparent glass. It is finding favor among those whose eyes are sensitive to glare.

ONE MOTOR TO FLY AS FAST AS THREE DO NOW

Tri-motored airplanes will be able to fly just as fast with one motor as they do now on three when designers improve the streamlining to the point where the flow of air around the ships is smooth and free from eddies. This is the opinion of Dr. Joseph S. Ames, chairman of the national advisory committee for aeronautics, who has found, from careful estimates, that an airplane can maintain its speed with one-third the power ordinarily used if the flow of air around it is of that description. The drag of different parts of a ship can be studied separately in wind tunnels, but the drag of the machine as a whole, due to distortion of flow when the parts are assembled, may be twice as great as the sum of its parts. This additional handicap, called interference drag, can be studied only by placing the entire ship in the throat of a wind tunnel. No tunnel large enough for this purpose now is in existence, but one is being constructed at Langley field, Va. The largest tunnel at present has an open throat twenty feet in diameter and produces an air stream having a velocity of 100 miles an hour.

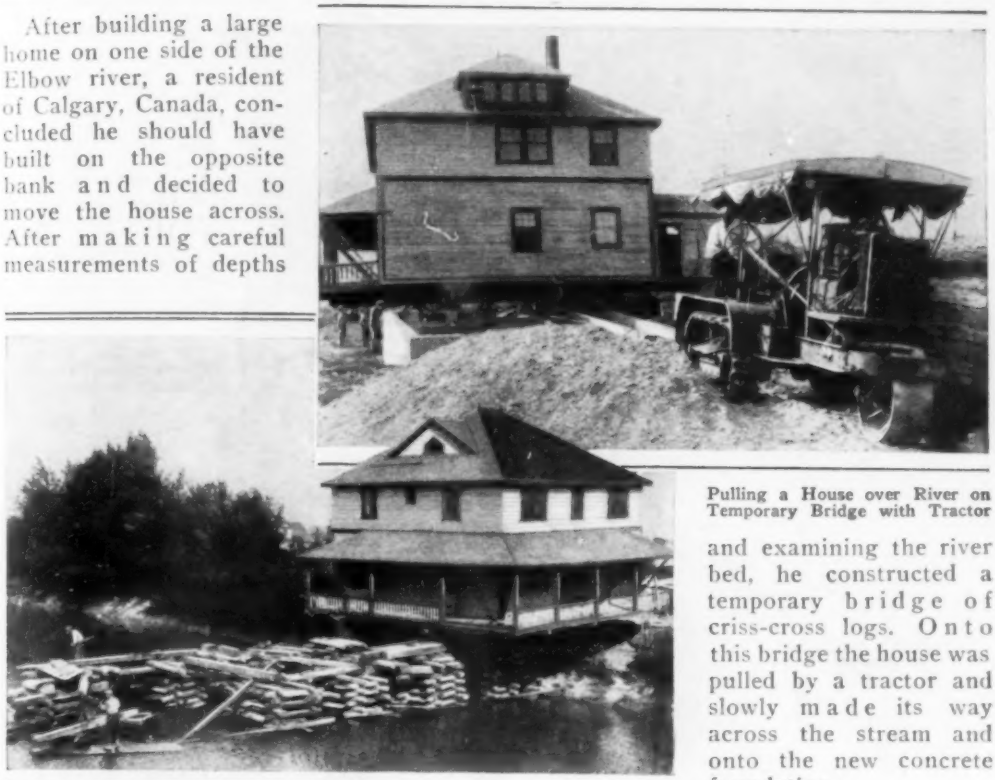
HIDDEN FAULTS IN AIRPLANES REVEALED BY "STROBOGLOW"

Imperfections in airplane propellers, and in other objects, are revealed while the units are in motion by means of the "stroboglow," a flashlight device developed by Westinghouse research engineers for greater safety in flying. In examining an airplane propeller, for instance, the test is made at night, as darkness is essential to the operation of the device. The light flashes are regulated to appear at intervals to correspond to the speed of the propeller. This makes the "prop" appear motionless although it is spinning at more than 1,000 revolutions per minute. The slightest crack or irregular movement is said to be plainly visible as the lights are flashed on and off. The device is also used to detect the movement of valves in gasoline engines, the vibration of meshed gears, or the slip of a belt moving on a pulley. The stroboglow already has been employed to test planes at several airports to make sure that both engine and propeller are in good condition.

Using the "Stroboglow," a Special Flashlight, Operated through Radio Tubes, to Examine a Spinning Propeller

HOUSE MOVED OVER RIVER ON TEMPORARY BRIDGE

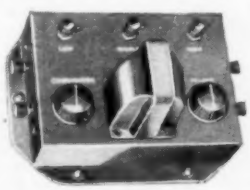
After building a large home on one side of the Elbow river, a resident of Calgary, Canada, concluded he should have built on the opposite bank and decided to move the house across. After making careful measurements of depths and examining the river bed, he constructed a temporary bridge of criss-cross logs. Onto this bridge the house was pulled by a tractor and slowly made its way across the stream and onto the new concrete foundation.



Pulling a House over River on Temporary Bridge with Tractor

TONE IMPROVER FOR RADIO SET AIDS TALKING MOVIES

To round out and perfect the tone quality of amplified speech or music, a control unit has been introduced for wide application. It is especially useful in connection with talking-picture apparatus, according to reports, as it eliminates needle scratch from records, hiss from films and microphone noises, and is said to add brilliance and depth so often lacking in reproduced music. The unit is also suitable for use following radio set detectors, and in general use immediately precedes the main amplifier. Controls are provided for regulating the high, low and middle ranges to suit the operator. Switches and controls enable him to select the frequency ranges to be softened, and the degree to which the volume is reduced.



DESTROYERS MAY BE BARGES

More than fifty old navy destroyers, soon to be scrapped by the government, would be used as barges to carry freight from Chicago to the Gulf of Mexico under a plan advocated by Rear Admiral Colby M. Chester. These boats, with several others too ancient for use in war service, could be equipped with Diesel engines and converted into tramp freighters for the Mississippi river service and the Great Lakes canal systems, at an estimated cost of about $100,000. This would allow these boats to carry freight from Chicago, Pittsburgh, Cairo and St. Louis to the sea and thence to foreign ports without transshipment.

NATURE WONDERS SEEN THROUGH CAMERA LENS

A Monarch and a Silverspot Butterfly Meet Face to Face, and, Below at Left, Close View of the Wings of the Io Moth; the Owl-Like Pattern Is One of Nature's Amusing Oddities; in Many Instances, the Designs and Colors of Insects' Wings and Bodies Constitute Effective Protection to Conceal Them from Their Enemies as the Color Scheme Makes Them Difficult to Detect

The Bald-Faced Hornet at Close Range, Showing Its Kidney-Shaped Eyes, Its Jointed Antennæ and Pincerlike Mandibles, Which Are Used to Strip Off Pieces of Wood from Buildings, Old Fences and Other Places; This Material Is Masticated into a Pulp for Building the Hornet's Nest; at Left, Contrast Study of the Faces of a Bat and a Bullfrog

SAW HANDLES AND PIPE BOWLS FROM SAME WOOD

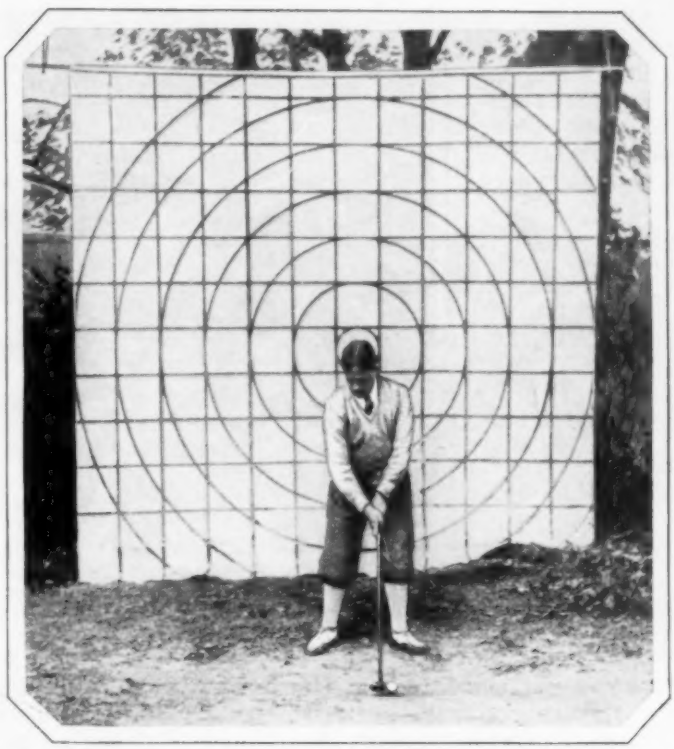
Millions of feet of apple wood are used annually in making handles for saws, and the cuttings from the handles are employed in turn in making bowls for pipes, so that little of the wood is wasted. The apple logs are air-seasoned for three years, after which they are inspected and sawed into proper lengths for the handles.

BAG ON FISHING COAT LEAVES HANDS FREE

Fishermen have less to worry about in the way of luggage when wearing a special coat that has five large pockets and a bag attached to the rear, to hold the fish. This bag is said to keep the fish in better condition than is usually possible in a willow basket, as there are arrangements for free circulation of air. The bottom is of aluminum, and the entire unit is detachable for easy cleaning. The coat has a roomy pocket for luncheon and two for bait. These have reversible linings to simplify the task of cleaning.

SLOW MOVIE OF GOLF SWING PLOTTED ON GRAPH

To aid the golf player in correcting faults in his swing, slow-motion pictures of the movements of the swing now may be charted on a huge graph that serves as the background for the player and the movie. The chart is a large sheet on which is an arrangement of squares and circles, the smallest circles on a level with the player's head. With this as a background, the slow-motion picture permits analysis of the stroke by plotting the position of club, head and hands at various positions, as the club descends and meets the ball.



Slow Movies of the Golfer's Swing Are Taken with This Graph as a Background, so the Stroke Can Be Plotted and Faults Corrected

NAIL HELD BY HAMMER CLAW FOR INITIAL BLOW

To hold a nail for the first tap, and leave it in position for successive blows, a hammer is provided with a claw attachment which fastens to the side of the handle. The claw itself terminates at the side of the hammer head, the nail being inserted in it and the first tap made with the side.

METAL FURNITURE OFFERS BEAUTY AND COMFORT

New styles of furniture in metal and other materials not usually employed

Furniture of Chromium-Plated Seamless Steel Tubing, Upholstered in Rayon, Combines Beauty and Utility; Note Compartments in Sofa Arm

in household articles, are appearing on the markets. Novel chairs, tables and divans in simple, modern designs by Donald Deskey, a New York artisan who forsook architecture to build furniture, illustrate some of the chief tendencies in the latest furniture. Seamless, cold-drawn steel tubing, plated with gleaming chromium is employed for the framework. It is indestructible and has a chief advantage in being easily kept clean and bright, so that the dusting problem is almost eliminated. There are no later expenses for refinishing or repairing. Formica, a composition material, is being widely employed as a substitute for wood in the table tops. It takes a high gloss and is also impervious to stains and burns. The upholstery in the chair and divan illustrated here is in a special rayon. At either end, in the arms of the divan, are handy compartments for the smoker or for holding small articles for sewing, decks of cards, or such things. "Permatex," another special material, is being widely used for upholstery.

LAWN EDGER LIKE A SCOOTER IS EASY TO OPERATE

Shaped and operated like a child's scooter, a lawn edger does away with much of the hard labor of performing this work. A movable handle, which is coupled to a pawl and ratchet, enables the operator to apply considerable leverage, and a platform is provided to hold the cutting disk in the soil by the operator's weight. A wooden roller, or disk hub, carries the edger on sidewalk or driveway, while the rear is equipped with a steel skid.

Lawn Edger, Shaped and Operated Like a Child's Scooter, Which Makes This Hard Task Easier

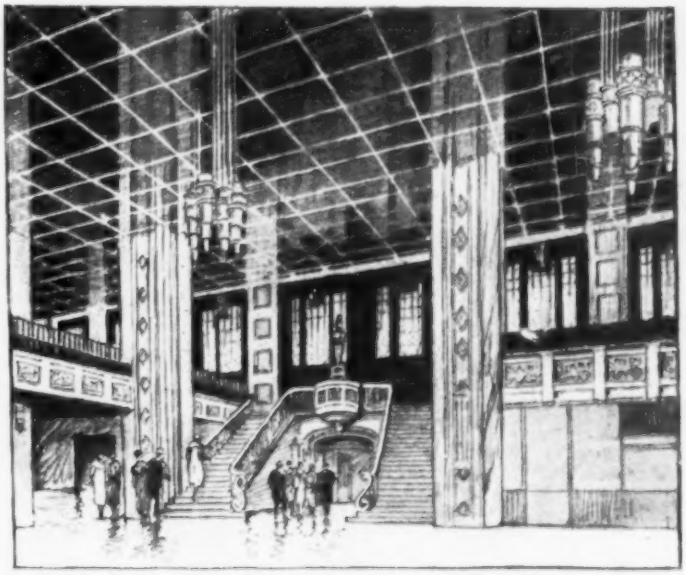
WOODEN WHEELS FOR SUBWAY ARE NOISELESS

London's subways and tramways are experimenting with wooden car wheels, which not only are less noisy than the metal ones, but, in addition, are said to possess superior strength, endurance, resilience, and are lighter in weight. It is a laminated disk wheel, each layer being composed of six or more sectors of spruce wood. In each sector of the circle the grain runs in a different direction, successive laminations being superimposed in such a way that the joints of adjacent disks do not coincide. This is the same principle as that employed in the laminated-wood airplane propeller and has been used for centuries by masons in laying brick.

MACHINE GUN FIRED BY AIR TO AID TARGET PRACTICE

Round lead balls are fired with sufficient force from a pneumatic machine gun, recently introduced, to penetrate a quarter of an inch of wood at 100 feet. Compressed air at 200 pounds to the square inch furnishes the force for the missiles which are supplied from a magazine that holds about 300 balls. The gun was devised especially for shooting galleries, but is expected to be of aid to army gunners at target practice or for sporting purposes.

¶The film of a sound moving picture wears out after fifty to seventy-five days of showing, whereas the silent films last from ninety to 120 days.



Artist's Drawing of Hotel-Lobby Ceiling in Black Glass; the Reflection Gives the Effect of a Much Higher Room

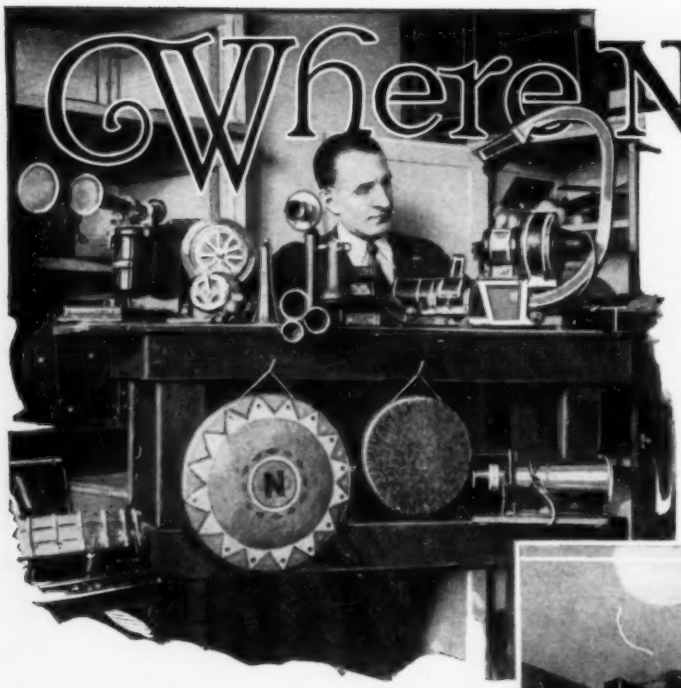
"INVISIBLE" CEILING OF GLASS LATEST HOTEL NOVELTY

Black glass as the ceiling in the lobby of a hotel now under construction in Kansas City, Mo., will reflect the floor and side walls in such a manner as to create the effect of an invisible ceiling. The glass will also give the impression of greater height to the lobby and will be more easily kept clean than usual materials. Floor and walls are of marble up to the mezzanine level, where walnut panels are used to the ceiling.

AUTOMATIC ELECTRIC LIGHTER OPERATES WHEN TIPPED

Automatically lighting and righting itself, an electric cigar lighter is operated merely by picking it up and tipping it. When upright or even upside down, it cannot light, and it is so balanced that, when laid down, it automatically rights itself and turns off the current. The bakelite base is in various colors, and the cap in different metal finishes.

Where Noise-



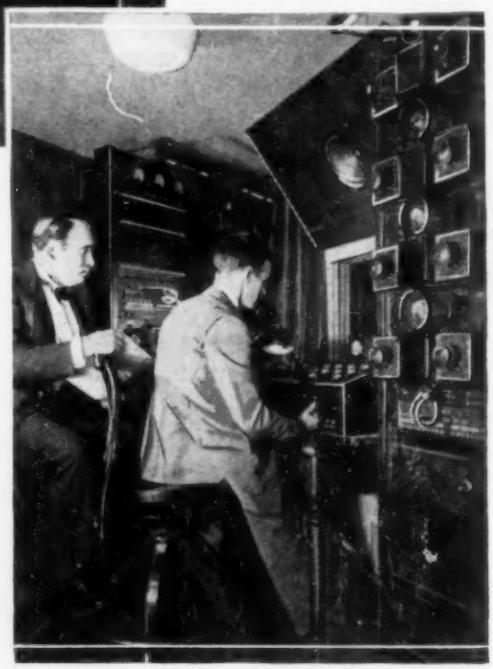
Reproducing the Sounds of a Sawmill for the Radio; Other Noise-Making Instruments Are Shown

BEING the approaching footsteps in a broadcast play has become a profession, and A. W. Nichols, of New York, has invested more than $10,000 in noise devices to imitate horses, guns, engines, street cars, sawmills and cash registers, and he has about three thousand other "props" of the broadcast stage. He is considered the dean of the noise-making profession, having begun his art twenty-three years ago, when he made funny sounds behind the motion-picture screen of Lyman Howe, the travel lecturer.

Nichols has seventeen patents to cover his major inventions, such as a contraption which paddles a banjo head to imitate a machine gun. A real machine gun sounds something like a typewriter when broadcast, and it cost Nichols several months of development work before he perfected the paddle gun. For long-range machine-gun fire, he uses the paddles on a leather cushion. His assistant and general manager is his wife, and he will permit none other to collaborate with him in his studio work.

Nichols has built a complete sawmill which he can carry in his arms. An electric motor operates it to make all sawing noises without the use of wood or a saw. He is a student of noises and has learned to operate this machine so that it apparently cuts pine knots, and the sound of the saw changes as it bites into a log.

More than a score of electric motors are employed to operate novel sound instruments. One twirls a little ball on a chain to imitate a riveting machine. Others operate automobile horns, sirens, wind and thunder machines, imitation street cars and gasoline engines.



Mixing the Music of a Chicago Civic-Opera Performance as It Is Being Broadcast

There is a difference between an ordinary locomotive and one which hauls freight, says Nichols. The first is imitated by rubbing steel wires over a tin

The Chicago Daily News Concert Orchestra Playing in the Spacious Studio of WMAQ; the Walls Are Lined with a Special Acoustic Material Composed Largely of a Glass Substance

box which is properly roughened and attached to an acoustic chamber. The large freight engine requires a larger box with a lever to create the roar.

For the patter of rain, he turns a large parchment cylinder and something inside continues to patter against the paper sides.

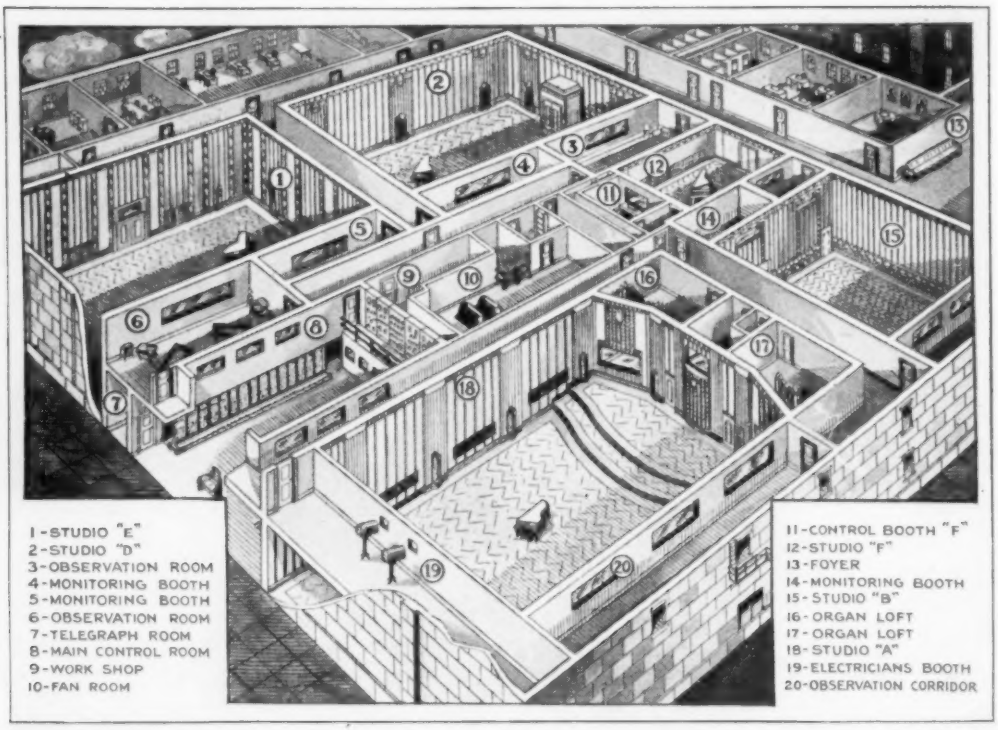
"Sand, beans, peas?"

"Maybe," replies Nichols, who has given his life to discovering the secrets of noise imitation, and has many tricks which are his professional property, and which even the broadcasting-studio managers do not know.

There is a secret about breaking glass which he reveals, however, for he realizes that most people cut their hands with the small splinters which fly.

"Use a wooden hammer. That's all," he explained. "I've been cutting my hands for years, using a steel hammer. I went so far as to build an automatic glass crash at one time. It operates electrically. A hammer smashes a pane of glass when I press the button, and the pieces fall down a chute to make a clatter.

"I lie awake nights thinking up new things. The toughest problem I ever had was to reproduce a street car for a microphone. It has more different kinds of noise than anything else I ever tackled. I have to imitate the motor, the sound of steel wheels against steel rails, the joints



Drawing of the Chicago Studios of the National Broadcasting Company Which Are Located near the Top of the Merchandise Mart, the World's Largest Business Building

in the track which make bumps, the bell, the trolley against the trolley wire, and a few more things you would never suspect."

One of the mysteries which he cannot explain is that nothing sounds so much like pouring a drink as pouring a drink. He uses an ordinary bottle and a glass for it, clinking them with proper artistry. However, he can wet the bottle's cork, rub it on the side of the bottle and imitate a cage of monkeys.

His cell doors is one of his most widely approved offerings in radio drama where the villain is at last locked up for keeps. There is no doubt about it when Nichols slams the door, which consists of half a dozen bars of steel chained together like a fan, so that they will fall against a steel frame with a proper clatter.

"In the old days," says Nichols, "for a crash I used to drop a plank and an armful of junk, but no more. I study all the sounds, even to this."

He turned the crank of a little toy he has made, and the noise of automobile tires skidding on dry asphalt was reproduced with a chamois-covered roller, a little rosin and a few secrets which he alone understands.

In a small black box he keeps two cats and a lion. They are always ready to cry or roar when he pulls the strings which hang from the mysterious box.

He imitates a typewriter by clicking two flattened soda straws together, and makes body blows for a fight by striking a leather cushion with a hammer.

Several dozen bells are necessary to produce the sounds required. An electric doorbell does not broadcast well and must be imitated by a bicycle bell, operated by a spring instead of a vibrating armature. Among the other bells he uses are plates of steel of various sizes, the double bell for a telephone, trip gongs used at prize fights and in fire stations, and bells to give the impression of ambulances, police patrols and fire trucks.

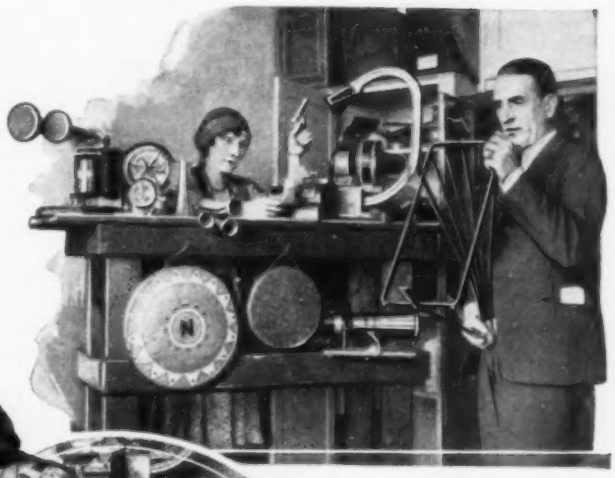
A rumbling wagon requires a box by itself, filled with clattering boards. Ocean waves are simulated with a kind of steel brush with long bristles, moved expertly over a drumhead.

All types of automobile horns are represented in the four large cabinets used by Nichols to guard his many devices. He also has horns to imitate fog signals, trains, ocean liners and the bawl of a cow.

Two motors imitate airplanes by the use of fans which are especially shaped. One is for a close-up and the other for a fade-out.

On one portable table is assembled a motor exhaust, cuckoo, siren, bear growl, pig squeal, telegraph key, anvil, box of gears, nose blower, castanets, tom-tom, fireworks, baby cry, chain rattle, sleigh bells, cloth tearing, bee buzz, fly hum, cork puller, acetylene torch, ambulance bell, rooster crow, hen cackle and tin-pan crash.

It is necessary for Nichols and his wife to study the manuscripts of radio plays and assemble the noise apparatus needed. They stand at their table in the broadcasting studio before their own microphone, which is blended or mixed with the microphones of the actors and the musicians a few feet away in the same studio. The sound makers keep their eyes upon the manuscript of the entertainment which is being broadcast, reading it and waiting their turn. Some of the sound-making devices must be held near the microphone and some several feet from it. A rehearsal or two is usually necessary, so that the radio operator who mixes the electrical impulses from the various microphones can learn the proper adjustment of his rheostats for each sound.



Reproducing an Escape from Prison, a Machine-Gun Battle, and the Sound of a Locomotive; Radio Noise-Making Requires Scores of Instruments

CAMERA IDENTIFIES DIAMONDS TO FOIL GEM THIEVES

"Fingerprints" of diamonds as infallible in identifying the stones as are the fingerprints of criminals, now may be made with a microphotographic camera. It takes pictures of gems enlarged from 150 to 350 times.

Toy Car Factory in England Which Has Applied American Methods of Automobile Production; Conveyors Carry the Autos to Workmen Who Turn Them Out at the Rate of a Thousand a Day

MASS PRODUCTION OF TOY CARS SPEEDS UP WORK

Following the example of large automobile factories, manufacturers of children's model motor cars in England now are turning out the toy autos on the mass-production principle. Traveling conveyors carry the cars through the factory, just as in the big plants, and when the demand justifies, a thousand cars a day can be turned out at one of these toy factories.

VACUUM CLEANER FOR MINES GETS RID OF ROCK DUST

Operating on a principle somewhat similar to the vacuum cleaner for homes, a dust trap for removal of rock dust from mines is in use in England. This dust often causes lung diseases, and in mines where surfaces are wet before drilling, air washing is used. When this is impossible, the vacuum cleaner comes into play. It consists of a hood attached to the drill in such a way that the dust which seeps out around the drill hole is collected into a hose attached to the hood and conveyed to a dust bag in which it is retained, the filtered air escaping through the bag.

SETSCREW FOR DOORKNOBS CAN'T WORK LOOSE

Of special interest to architects and builders is a doorknob setscrew containing a coil spring that binds against the thread to keep the screw from turning when the knob is fastened tight. Under repeated tests, this type of screw has failed to work loose of its own accord, but it can be removed with a screwdriver as easily as the ordinary kind.

TEST STEEL TIES ON ENGLISH RAILWAY

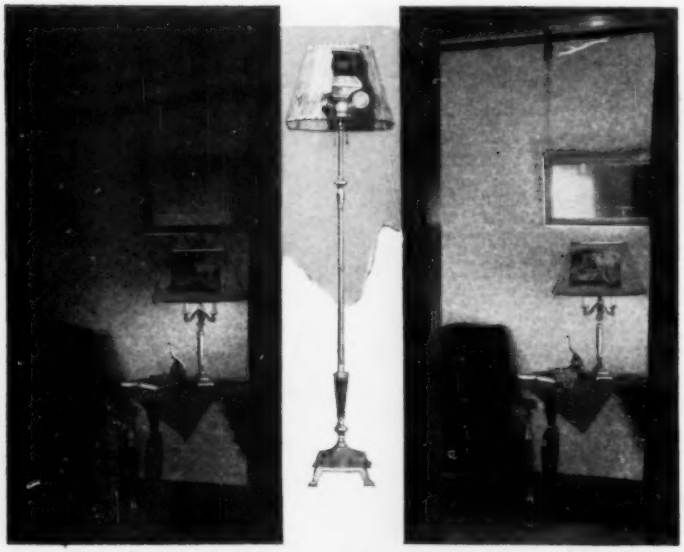
Steel ties, weighing, with the "chairs," 200 pounds, are being tried on a railway line in England, and engineers are awaiting the results of the experiment with interest. Will the chairs securely hold the rails under all temperature and other conditions? Will the rails give the necessary resilience to reduce the shock of the trains passing over them? Will the steel prove as durable as wood that has been treated with chemicals to reduce decay? These and other questions will be answered by the tests. The experiment recalls the time when iron rails were laid on stone sleepers. It was found that the arrangement did not allow sufficient elasticity under the car weight and was soon given up for ties of wood.

Fitting Rail into "Sleepers" on the Steel Ties Installed on a Stretch of Track in England

"Lumitone" Cabinet with Roll; at the Control Keys, and a Lighting Display That Simulates a Fountain of Changing Colors

COLOR CABINET PLAYS LIGHTS FROM MOVING ROLL

Remote control for flickerless colored floodlighting in changing combinations is accomplished through a cabinet and keyboard installation adaptable to stores, fountains, show windows, statues, homes and many other places. Keys, like those on a pipe organ, permit the selection of color combinations at will, or prearranged effects may be produced from the roll which actuates the switches and dimmers contained in the cabinet. The roll automatically reverses itself after one unwinding and plays the program backward, repeating the process as long as the machine is in operation. There are four holes in the tracker bar over which the record roll passes, for each circuit. One of these turns on the current, one moves the dimmer up, one moves the dimmer down and one turns the current off. As the perforated paper roll passes these openings, the functions of each are performed.



Lamp Equipped with the Special Floodlight Bulb in Top, and How Room Appears with It On and Off; Center, Sectional View

FLOODLIGHT FOR HOUSE LAMPS BRIGHTENS ENTIRE ROOM

Indirect lighting, sufficient to illuminate an entire room, is now possible from your portable table or floor lamp with the aid of an adapter unit recently introduced. It makes two lamps out of one, an art lamp and a flood lamp. The attachment is easily put on and, besides the smaller bulbs for reading or writing, has a powerful reflector that throws light from a large bulb upon the ceiling. The lower portion of the reflector is of opal glass which permits light to shine through the shade so that, when the big light is on, the others can be turned off. The effect is pleasing and restful to the eyes, adequate illumination is afforded, and the cost of a separate lamp is saved. The adapter will fit practically any electric floor or table-lamp standard, and any shade can be used, provided the opening at the top is at least six inches in diameter.

Electrically Driven Turntable for Testing Types of Lead Used in Pencils

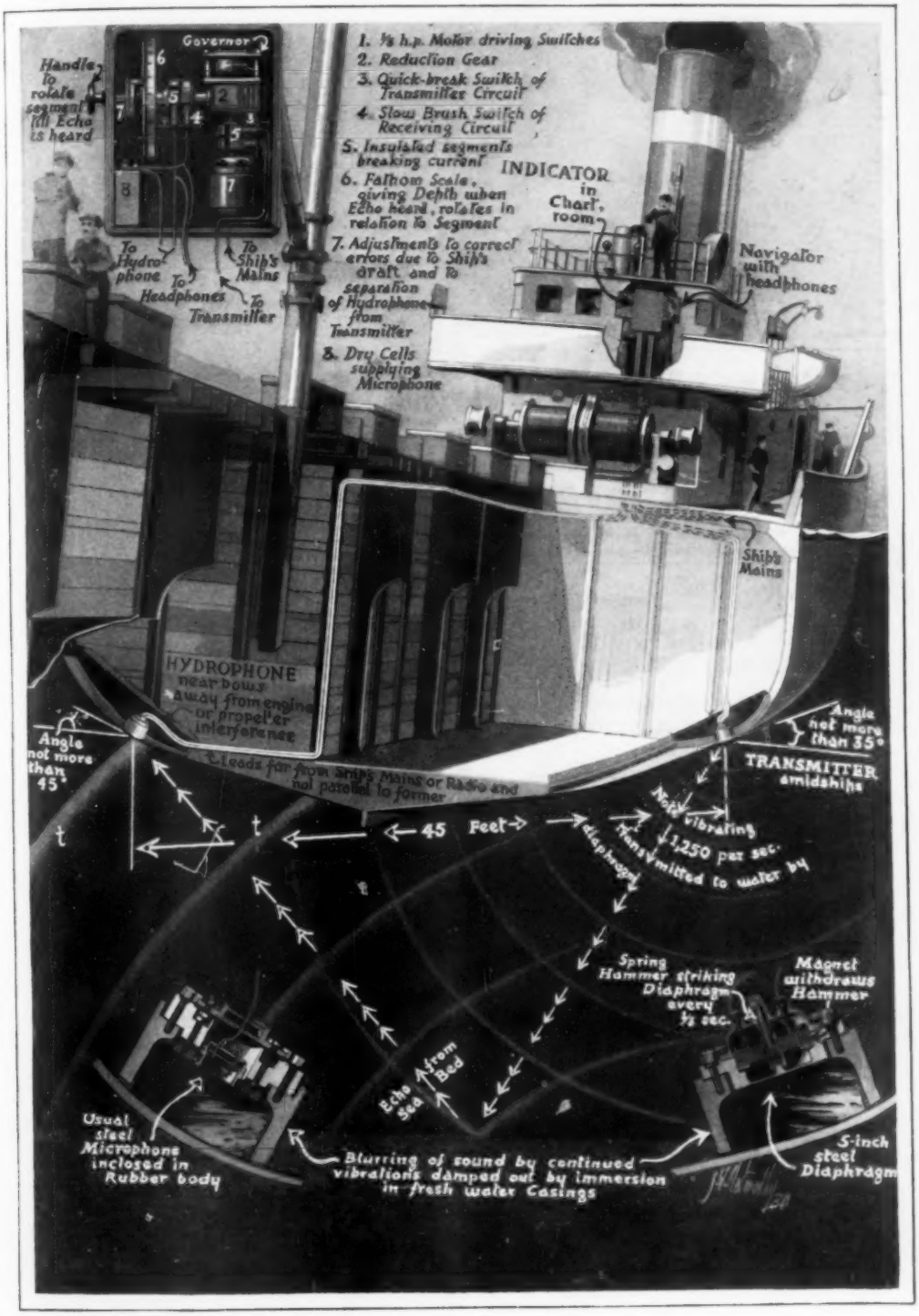
PLANTS THAT BITE BUGS

Certain kinds of water plants are deadly foes of breeding mosquitoes, and one species of water-weed, the bladderwort, actually swallows and digests the wigglers. On its underwater stems are thousands of tiny, hollow green globes, each opening at one end in a little mouth fringed with hairlike appendages. These globes are under internal tension, and when a wiggler brushes against one of the hairs, the mouth suddenly flies open and sucks the luckless insect in. Inside, the wiggler quickly dies and is digested by the plant. Certain other types of water plants, particularly the members of the Chara family, in some way kill most of the mosquito larvæ near them.

DURABILITY OF PENCIL LEADS TESTED ON TURNTABLE

Wearing qualities of different types of lead for use in pencils are tested by an apparatus somewhat resembling a phonograph. An electrically driven turntable, covered with drawing paper, contains a center disk which revolves with the turntable. This disk is connected to two other similar disks, at the rim of the turntable, by a spring belt, thus driving these disks. One of them has four metal tubes in which the leads are inserted. Thus both the turntable and the disk containing the leads revolve, enabling a simultaneous test for the comparison of four types of lead, all under equal pressure.

HOW ECHOES TELL DEPTH OF WATER UNDER SHIP


Governor
Handle to rotate segment till Echo is heard
1. ⅓ h.p. Motor driving Switches
2. Reduction Gear
3. Quick-break Switch of Transmitter Circuit
4. Slow Brush Switch of Receiving Circuit
5. Insulated segments breaking current
6. Fathom Scale, giving Depth when Echo heard, rotates in relation to Segment
7. Adjustments to correct errors due to Ship's draft and to separation of Hydrophone from Transmitter
8. Dry Cells supplying Microphone
INDICATOR in Chart room
To Hydrophone
To Headphones
To Ship's Mains
To Transmitter
Navigator with headphones
Ship's Mains
HYDROPHONE near bows away from engine or propeller interference
Angle not more than 45°
Angle not more than 35°
TRANSMITTER amidships
Leads far from Ships Mains or Radio and not parallel to former
t
t
45 Feet
Nickel vibrating 1,250 per sec.
Transmitted to water by diaphragm
Spring Hammer striking Diaphragm every ½ sec.
Magnet withdraws Hammer
Echo from Bed
Sea
Usual steel Microphone inclosed in Rubber body
Blurring of sound by continued vibrations damped out by immersion in fresh water Casings
5-inch steel Diaphragm

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Shooting a Billiard Ball through 100 Others without a Hit, and Diagram of the Feat

PASSING HUNDRED BILLIARD BALLS WITHOUT A HIT

Billiard players marveled recently when Otto Reiselt, cue expert, shot a ball around a table containing 115 other balls without touching one until striking the last two for a perfect hit. They marveled still more when 120 balls were placed on the table and a perfect six-cushion shot was made, the ball striking the cushion six times and traveling more than forty feet in its path about the table without touching any others except the balls at which it was aimed. The secret of such an exhibition lies partly in the skill of the player and partly in the manner of arranging the balls. The path of the cue ball in making a six-cushion shot first is marked on the table with chalk after which the others are arranged so that none is in its path. Thus the one ball passes through a lane made by the others and naturally strikes none of them, provided the player has the necessary skill to send the ball through the path with only a fraction of an inch to spare on each side. The chalk mark of the path is removed before the shot.

PAINT THINNED WITH WATER

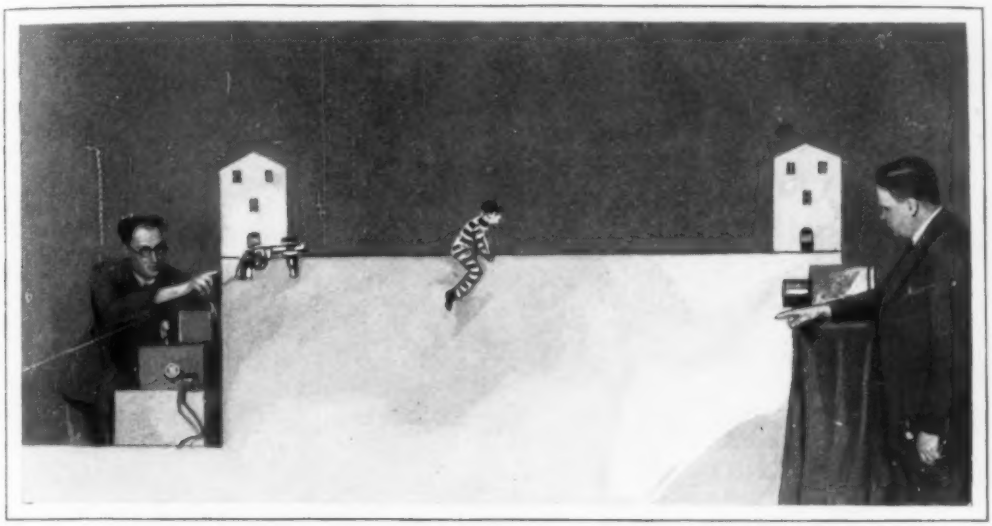
Paint in the form of thick paste which can be thinned with water instead of turpentine now is available for interior use, the pigment being the same as that used in high-grade oil paint. Half the volume of water is added and the paint dries dustproof in two hours. It does not yellow with age, can be applied to any surface, and subsequent coats may be applied without removing it. It works equally well on wood, brick, metal, concrete or plaster.

SLICKER FOR THE RUMBLE SEAT KEEPS PASSENGERS DRY

Protection for passengers in the rumble seat of the auto during a sudden shower is afforded by a rubberized slicker installed in a few minutes without the aid of snaps, hooks, buttons or strings. When not in use, the slicker folds into a compact bag and is placed in position with sponge-rubber cleats. They are modeled so that an opening is provided for the face and a hood for the head.

Rubber Slicker for Rumble-Seat Passengers; It Folds into Compact Bag When Not in Use

ELECTRIC EYE ON PRISON WALL TO STOP ESCAPES



Model Showing How the Electric Eye, or Photo-Electric Cell, Serves as Sentry on a Prison Wall, Sounding an Alarm and Firing a Gun When a Convict Interrupts the Light Rays

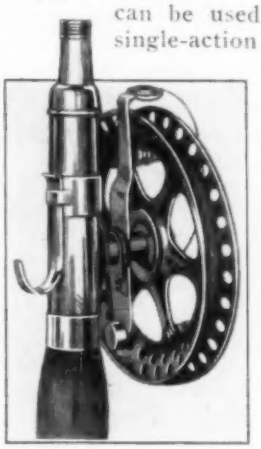
Sentries marching back and forth on prison walls now may be replaced by an electric eye which fires a gun at a prisoner trying to scale the wall and sounds an alarm simultaneously. The eye, recently demonstrated, is a photo-electric cell toward which a beam of light is directed along the top of the wall. When the body of the escaping convict interrupts the light ray, the cell reacts by firing the gun aimed along the wall, and ringing the alarm.

AIR PURIFIER FOR RAILWAY CAR MAKES OWN WEATHER

Railroad cars now can manufacture their own weather to suit the comfort of passengers, by the use of an air-conditioning system recently tried out with success. Tests in a dining car on a warm day, with full winter heat turned on and intensified by heat from the kitchen, revealed that it was possible to reduce the temperature from ninety-three to seventy degrees in twenty minutes. Air filters remove cinders, dust and foreign material from the air as it is admitted to the car, after which the air passes over cooling coils until brought to the desired temperature, when it is forced into the car through overhead insulated ducts. The system is equipped with an automatic control. The entire apparatus is electrically operated, double-sash windows and doors being kept closed in order to allow the air conditioner to supply all the cool, filtered air required.

LINE CONTROL ON FISHING REEL PREVENTS BACKLASH

Preventing backlash and making unnecessary the usual thumbing as the line is payed out, a line-control fishing reel can be used like the ordinary single-action reel. The control, aiding the amateur to gain proficiency in casting, is inserted in the hub of the line guard and can be used for still fishing as well as casting. The spool has a capacity of 100 yards of fifteen-pound-test line, although the reel weighs but five ounces. When the bait strikes the water the reel stops automatically.



Climbing a Ladder of Windows; Workers Cleaning Some of the 500,000 Panes of Glass of the Crystal Palace, London

CLEANING HUGE ROOF OF GLASS TESTS WORKERS' SKILL

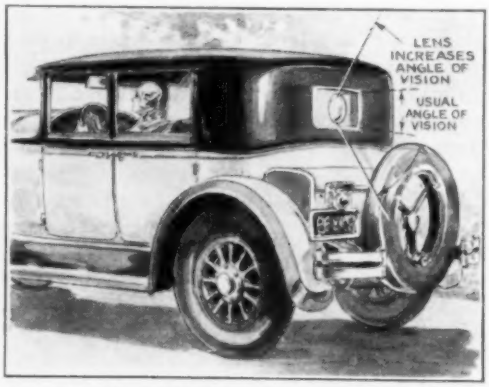
Cleaning the 500,000 glass panes of the Crystal palace, London, calls for skilled and careful workers. Ladders are used in some places, but in others, the men have to cling to the narrow steel framework while cleaning the glass. The entire exterior is thoroughly cleaned each year.

WHY CHICKEN JERKS ITS HEAD REVEALED BY SCIENCE

A chicken jerks its head when running in order that it may see better, scientists of Johns Hopkins University declare. By careful examination of slow-motion pictures of the fowls, and by other means, they found that a chicken's head moves forward only and its body catches up. Then the head jerks forward again and the process is repeated. This prevents blurring and gives the fowl a succession of clear pictures, the scientists conclude. When the specimen was hooded, its head no longer endeavored to keep one jump ahead of its body. Ducks and swans, when swimming, do not jerk the head but the entire body moves forward slowly. The study showed that ducks appear to have a kind of head movement, just the opposite to that of the chickens.

REAR-VISION LENS FOR AUTO GIVES BETTER VIEW

To allow greater visibility through the rear window of the car when backing up, and to eliminate the glare that sometimes shines from headlights of autos behind, a small lens has been installed in the panel to take the place of the usual glass window. While it occupies much less space than the pane, it is said to afford a much better view of the rear from the driver's seat, occupants are spared the danger of breaking glass in case of an accident, and the small lens also gives greater privacy to passengers in the rear seats. The lens is intended to function in connection with the mirror on the windshield and is said to give a wider field of vision because of the character of the special lens.



Rear-Vision Lens for Automobiles Is Used in Connection with the Mirror in Front for Wider View

The "WEST POINT" of the AIR

WHAT does the army air corps do in peace times? Previous installments of the "'West Point' of the Air" have told how and where the flying cadets are trained. What happens to the man who elects to remain awhile in the service after winning his wings? He has many absorbing duties, but perhaps the most interesting are at the various maneuvers in which the flyers have a chance to apply the knowledge they have gained and the latest equipment and the most advanced ideas in tactics of the air are given practical tests, to determine their real worth in case of actual warfare.

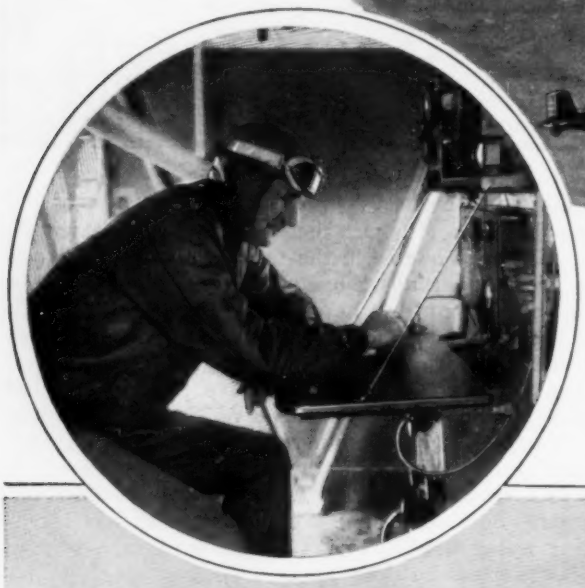
The Pacific coast recently was the scene of the most extensive mimic war ever staged by the air corps. More than 150 planes, under Brig. Gen. William E. Gillmore, routed a mythical "Red" enemy which supposedly had taken possession of California south of Santa Cruz. The flying "Blue" forces technically sunk the enemy fleet which had bottled up San Francisco, checked the advance of the Red troops and held them until theoretical reinforcements arrived. Pursuit, attack, bombardment and observation planes were recruited from seven flying fields. Cargo planes transported forty loads of equipment to Mather field, headquarters for the maneuvers, so that, for the first time in an engagement of this kind, motor trucks were virtually dispensed with.

Commanding officers agreed that the maneuvers further showed the importance of air forces in defense and attack. The engagements also developed several practical points. Pursuit planes, the officers concluded, should carry two pilots and their speed should be increased. Attack planes should be camouflaged in dark olive-green, fly close to the ground and be directed by radio from observation planes at altitudes of 5,000 feet and more. The officials saw the importance of having two types of bombing planes, a light one for day-service and a heavier one that could carry bombs weighing up to 4,000 pounds for night attacks.

Among the notable accomplishments during the maneuvers were the remarkable high-altitude flights of pursuit planes that kept their formation, then broke up for "dog fights" and other tactics at heights that showed the practicability of raising the "fighting ceiling" to more than five miles.

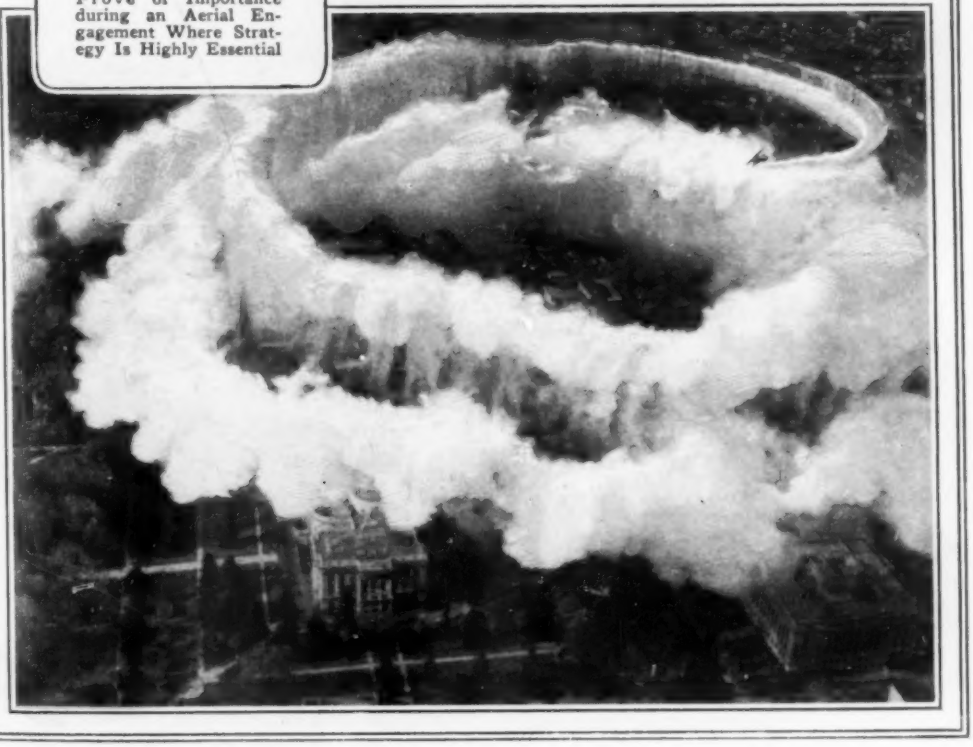
A Fighting Formation High over the Sierra Nevada Mountains Where Attacks Were Made on a Supposedly Hidden Enemy during the Air Corps Maneuvers on the Pacific Coast

In the Radio Room of a Bombing Plane, from Which Directions Were Successfully Sent by Wireless for Attacks by the Ninety-Fifth Pursuit Squadron, Known as "California's Own"



Brig. Gen. William E. Gillmore Inspecting the Nineteenth Attack Squadron Just Before a Review of the Entire Air Force Assembled for the Mimic Warfare, in Which Four Tactical Units of the Air Corps, Pursuit, Attack, Bombardment and Observation Planes, Participated against a Mythical "Red" Force That Supposedly Had Taken Possession of Part of California

Captain Elmendorf, Commanding Officer of the Ninety-Fifth Pursuit Squadron with Face Mask Adjusted for High-Altitude Fighting during the Mimic Air Battles on the Pacific Coast; These Maneuvers Were the Most Extensive Ever Staged by the Army Air Corps, Which Functioned without Regard to the Operation of Ground Troops



Dropping a Smoke Screen over the City of Sacramento, to Show How Large Areas Could Quickly Be Hidden from the Enemy Air Forces; Note the Difference between the Smoke Screen and the Smoke Curtain Illustrated on a Following Page; Both Would Prove of Importance during an Aerial Engagement Where Strategy Is Highly Essential

In the Circle, Machine Gun Installed on One of the Planes; Below, a Bomber Hanging a Smoke Curtain, and Flyers Equipped for High-Altitude Work; Each Man Wears Approximately Fifty Pounds of Clothing to Withstand Temperatures as Low as Sixty Degrees below Zero at a Height of 25,000 Feet or More; Oxygen Tanks Were Carried, and Communication Was Maintained by Radio, the Headsets Being Built into the Helmets; Successful High Flights and Engagements at Extreme Altitudes Featured the Recent Maneuvers; "Dog Fights" and Other Drills Were Performed at 25,000 Feet and Nineteen Pursuit Planes Climbed to 30,000 Feet; Night Photographs Were Taken from 2,500 to 3,000 Feet with Flashlight Powder and Flares Attached to Parachutes

The First Pursuit Squadron from Selfridge Field, Arriving for the Maneuvers, and, in Circle Below, Maj. Henry B. Clagatt, at Left, Talking over Plans for the Mimic Warfare with Brig. Gen. William E. Gillmore; They Were Responsible for the Movements of More Than 150 Planes

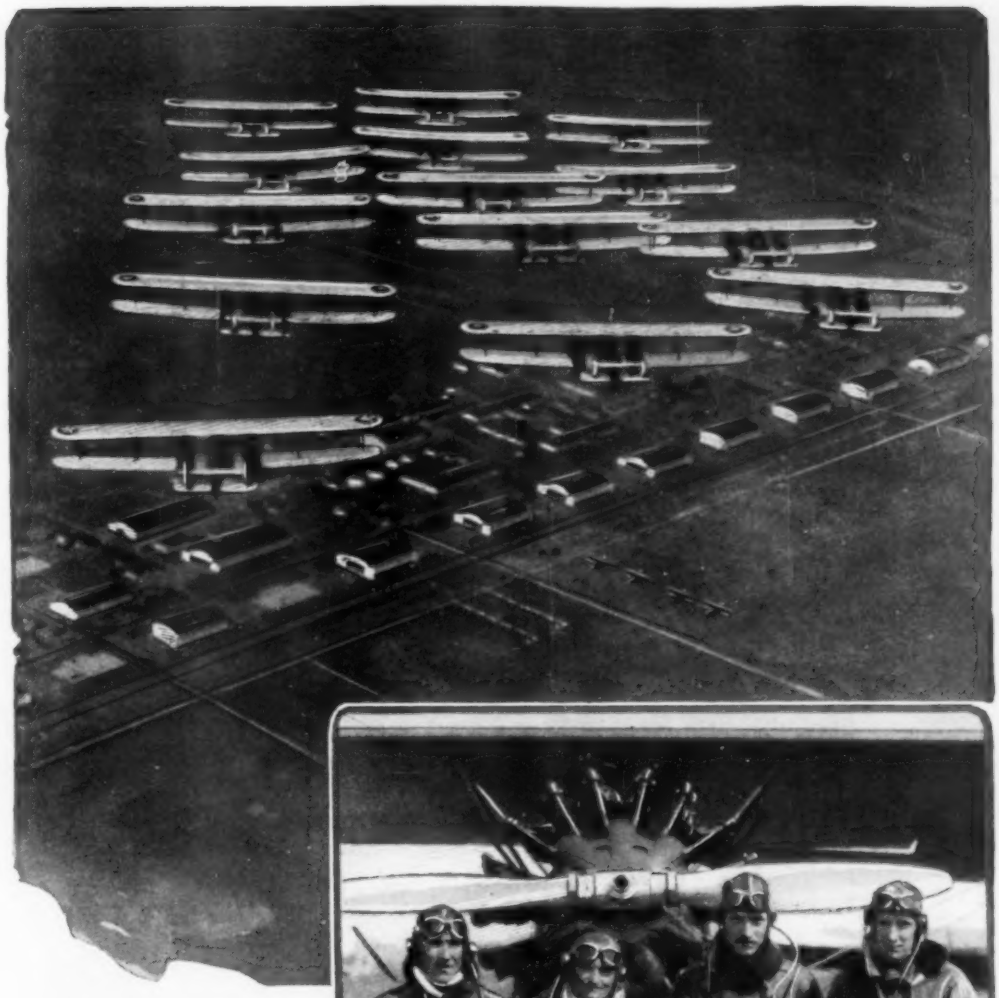
Uncle Sam's Latest Battleship of the Air, Which Was Flown at the Mather Field Maneuvers; It Is a Light Bombardment "No. 7" Plane with Three Motors, Totaling 1,100 Horsepower; It Carries Seven Machine Guns, Bombs Up to 2,000 Pounds in Weight and a Crew of Five Men; the Pacific Coast Tests, in the Opinion of the Commanding Officers, Further Demonstrated the Importance of the Bombing Plane as a Unit in an Aerial Detachment, Especially When Supplemented with Fast Pursuit and Attack Planes

Stepping Down Out of the Skies on a Mission of Battle; This Photograph Shows a Group of Pursuit Planes from Selfridge Field in Combat Formation, About to Simulate an Engagement with "Red" Planes over San Francisco Bay; the Ships Shown Here Were Members of the Victorious "Blue" Forces

Flyers with Radio Equipment and Phones Carried on Planes during the Aerial Action over San Francisco and Adjacent Territory; at the Right, the Colorful Emblem That Appears on Planes of One of the Pursuit Groups

Installing a Recording Barograph in Plane for Use during Test Flight; with These Instruments, Accurate Records of Altitudes Reached and Other Data Are Kept

In the Upper Photograph, the Pilot Has Released the Controls of the Giant Bombing Plane and Is Waving to a Photographer, While an Automatic Pilot Keeps the Bomber on an Even Keel; for the First Time in Aeronautical History, a Giant Bomber, Piloted by a Gyroscopic Device, Was Flown from Sacramento to San Francisco in the Army Maneuvers on the Pacific Coast; at the Left, Lieut. Marion Huggins with Elmer H. Sperry, Jr., at the Right; They Are Showing the Sperry Gyroscope Compass with Which Bombardment Planes Can Be Flown without the Attention of the Pilot, Who, in the Case of an Actual Battle, for Instance, Could Devote His Energies to the Guns and Crew



Tight Formation, Composed of Planes of the Second Bombardment Group, Flying over Mather Field during the Recent Army Maneuvers, and, Below, Officers Who Participated in the Mimic Attack on Crissy Field, San Francisco, Dressed in Their Fighting Togs; Note the Earphones for Receiving Radio Commands; Orders by Wireless, as Well as Improved Aircraft of Greater Efficiency Than Any That Ever Engaged in an Actual War, Featured the Sham Air Battles to Demonstrate the Tactics of Fighting from the Skies; a Fictitious Enemy Was Driven from San Francisco and Its Fleet Sunk, After It Had Bottled Up San Francisco Bay; the "Battle" Was Waged High over a Terrain of More Than 20,000 Square Miles

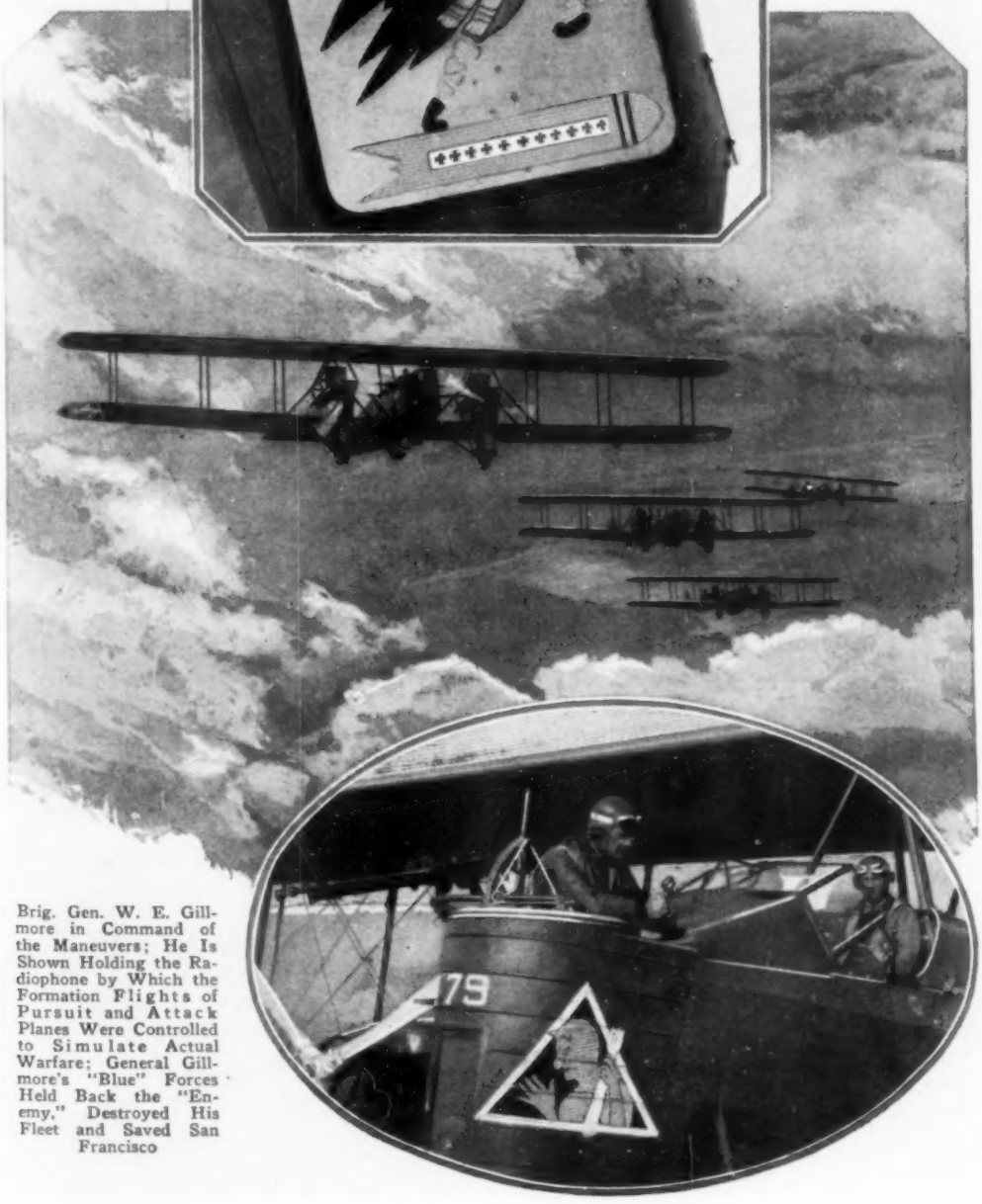
Artist's Drawing of Defense and Attack upon a City by Aircraft; in the Foreground a Bombing Squadron Is Approaching, and, in the Distance, a Defense Plane Is Spreading a Smoke Screen

Big Bombers Are Virtually Battleships, Capable of Tremendous Destruction; a Craft Carrying 1,200 Pounds of Bombs Has Been Suggested for Day, and One Carrying 4,000 Pounds for Night Service

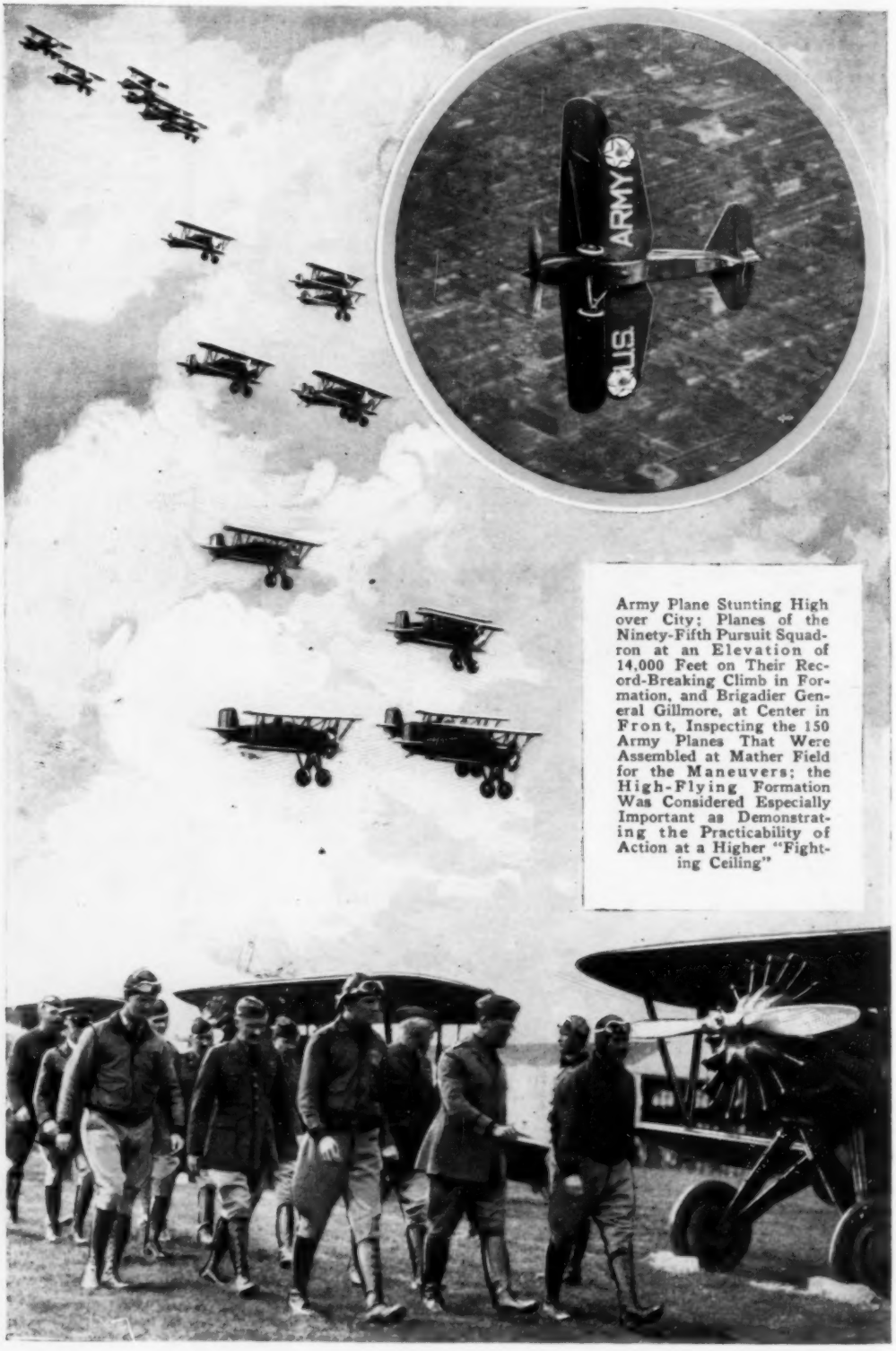
Above, Sixteen of the Army's Newest Attack Planes Coming Head-On; with Wings Almost Touching and Maintaining Perfect Formation, These Planes Are under the Direction of the Commander Who Instructs the Pilots by Radio; at Left, Pilots of the Ninety-Fifth Pursuit Squadron in Arctic Clothing, Needed in High Flying, and, Below, Placing Skids on the Landing Gear for Use Instead of Wheels When Descents Are to Be Made upon Ice or Snow; Cross-Country Flying Trips in Winter Test Planes and Pilots

Insigne of the Langley Field Bombers; the Terrifying Figureheads of Viking Ships and the "Eyes" on the Bows of Chinese Pirate Vessels Are Recalled in the Figures on the War Planes

Group of Bombers Roaring through the Air; after the Mather Field Maneuvers, Army Officials Were Further Convinced That There Should Be a Light Bomber for Day Work and Heavier Ones for Night



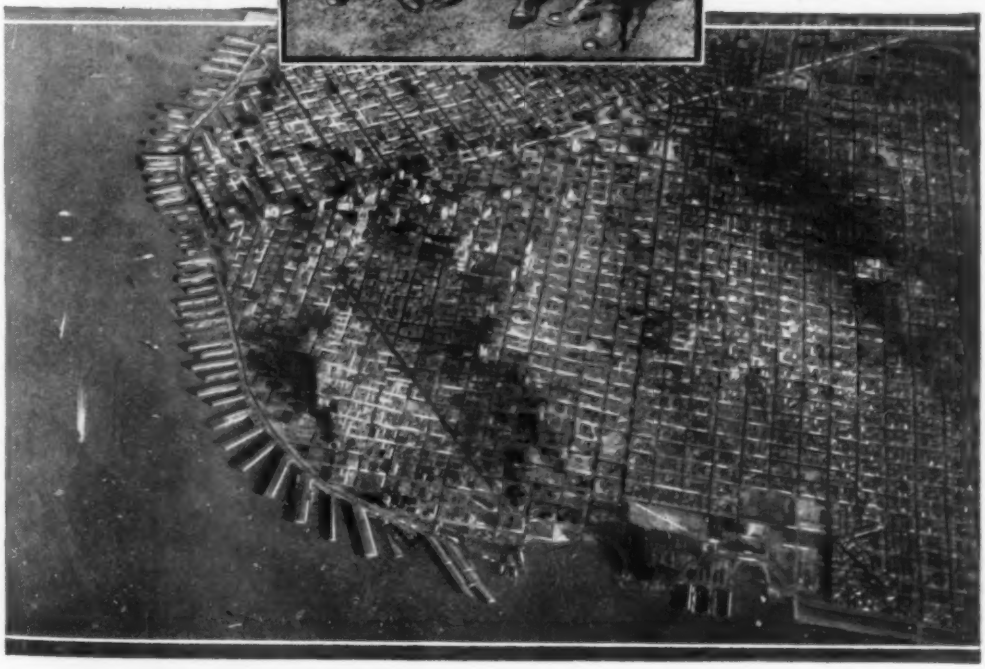
Brig. Gen. W. E. Gillmore in Command of the Maneuvers; He Is Shown Holding the Radiophone by Which the Formation Flights of Pursuit and Attack Planes Were Controlled to Simulate Actual Warfare; General Gillmore's "Blue" Forces Held Back the "Enemy," Destroyed His Fleet and Saved San Francisco



Army Plane Stunting High over City; Planes of the Ninety-Fifth Pursuit Squadron at an Elevation of 14,000 Feet on Their Record-Breaking Climb in Formation, and Brigadier General Gillmore, at Center in Front, Inspecting the 150 Army Planes That Were Assembled at Mather Field for the Maneuvers; the High-Flying Formation Was Considered Especially Important as Demonstrating the Practicability of Action at a Higher "Fighting Ceiling"

Class in Photo Hut, Showing the Various Types of Cameras Used in Aerial Photography, and, at Right, Three War Aces of the Army; from Left to Right, Capt. Frank O. D. Hunter, Capt. Victor Strahm and Lieut. J. S. Griffiths

An Aerial View of Part of the Water Front and the Main Part of San Francisco, Made from an Elevation of 6,000 Feet; in the Recent Maneuvers, This Area was "Destroyed" by the "Blue" Heavy Combat Planes Directed by Radio; Army Photographers Received Valuable Training during the Mimic War



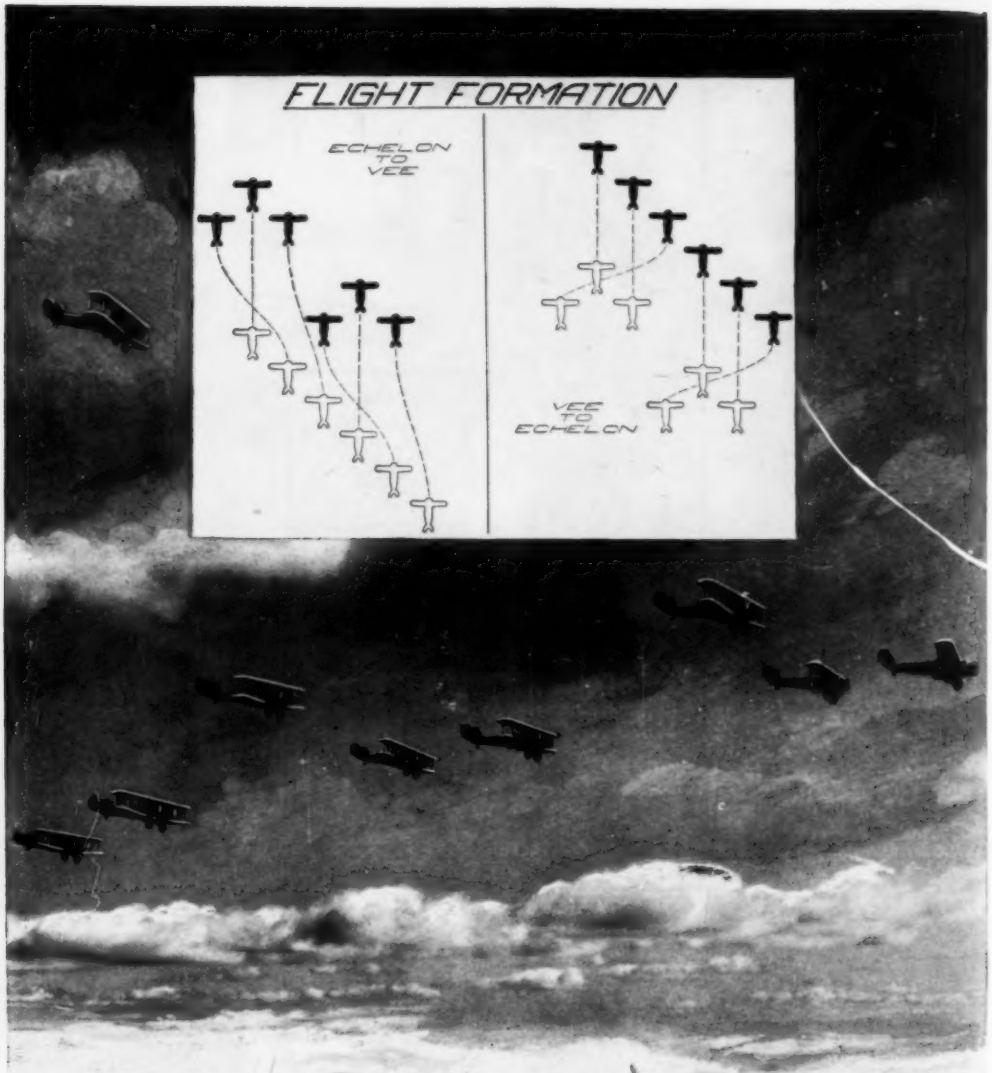


Diagram Showing Flight Formation in Changing from Echelon to Vee and Reverse, and below the Drawing, Planes Flying in Night-Attack Formation, with the Clouds Used as a Protective Screen, during the Recent Drills over a Part of the Sacramento Valley

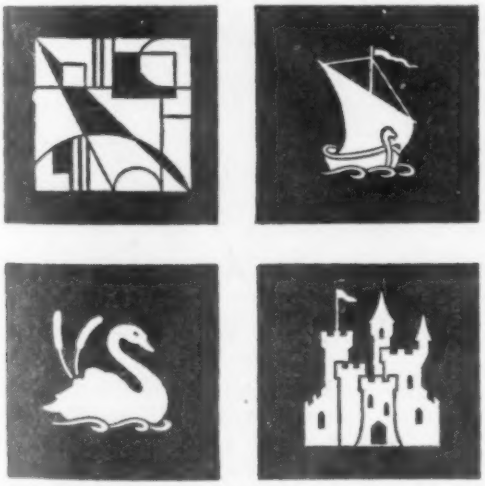
Lieutenants of the Ninety-Fifth Pursuit Squadron in High-Altitude Flying Togs Just before Making Their Record Climb, When Nineteen Planes Reached a Height of About 25,000 Feet before Abandoning Their Military Alinement; Separate Units Went Still Higher

SAFETY VALVE FOR GAS STOVE PREVENTS ACCIDENTS

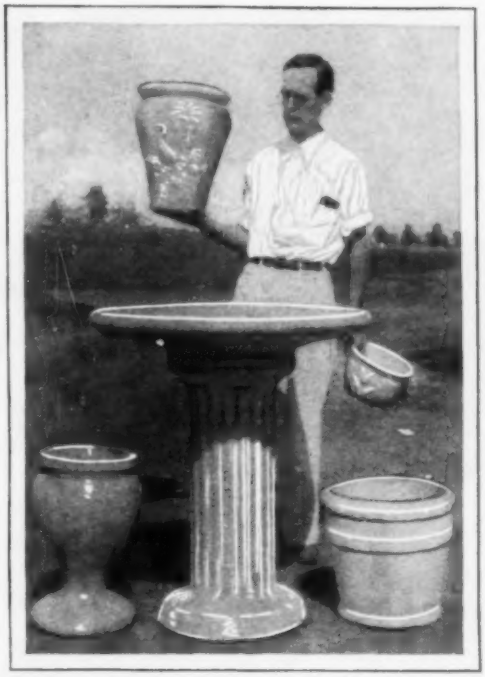
To prevent the accidental escape of gas from the kitchen range, a safety valve, operating somewhat like a thermostat, may be attached to the pilot light. The valve is made on the liquid-filled-bellows principle, and the constantly burning pilot light causes the liquid to expand, thus opening the valve attached to the main supply line. As long as the pilot light burns, the gas supply is unimpeded, but should the pilot light be put out by a breeze or the boiling over of a liquid, the valve shuts off the gas supply.

DECORATIVE LINOLEUM STRIPS FOR FLOOR BORDERS

Inset panels and strips are being employed to enlarge the decorative possibilities of linoleum floor coverings. The strips are feature borders for use around linoleum floors and are obtainable in plain and marble colors. They may be inserted as feature strips between wider borders or next to the field pattern, thus allowing multiple border effects. The panels, in two and three-foot squares, carry different designs including a swan, ship, castle, star, helmet, lion, deer and many others. They are made in two-color combinations and are installed by cutting out a piece of flooring and putting in the panel with linoleum cement.



Designs of Panels Intended for Inset in Linoleum Flooring to Enlarge Decorative Possibilities



Samples of Garden Furniture Made from Palmetto-Root Fibers, Mixed with a Special Cement

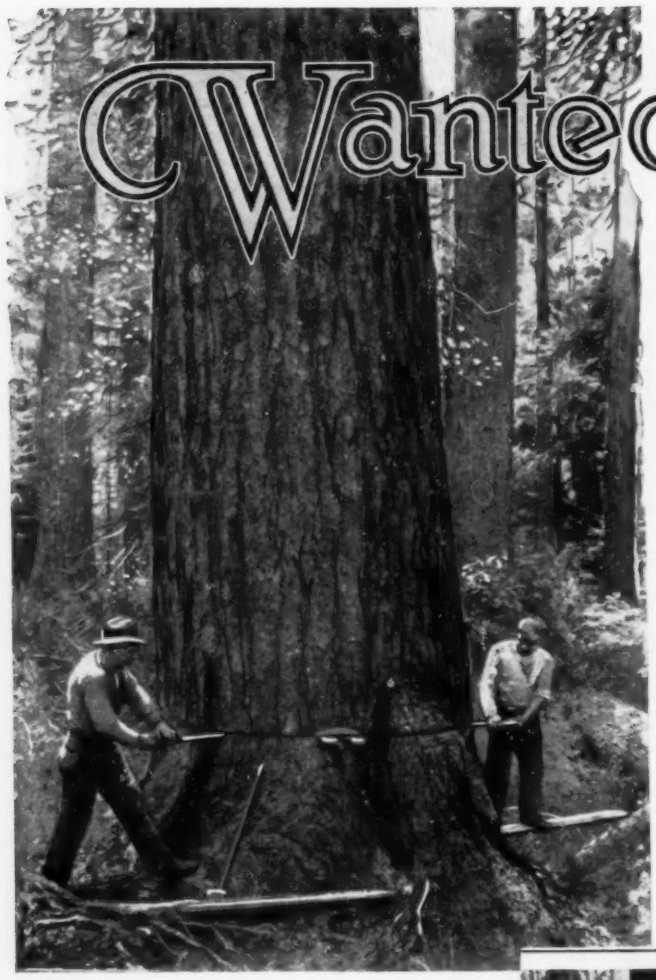
PALMETTO ROOTS AND CEMENT FOR MAKING FURNITURE

Palmetto roots, ordinarily considered worthless, are being used by a Florida inventor for making a number of weather-proof articles of furniture, statuary and bric-a-brac. The palmetto fiber is ground to varying grades and mixed with a special cement, making a product that is as light as wood and as strong and durable as concrete, being impervious to water and virtually unbreakable.

METAL BATH MAKES WOOD FIRE-RESISTANT

German scientists have developed a method of metallizing wood which makes it highly fire-resistant and proof against moisture absorption without destroying the natural pattern or grain. The wood is immersed in molten metal under pressure, the metal penetrating every part. The product is easily worked with ordinary tools. Its metallic surface and non-absorbent quality, which keeps it from swelling, may make it available for bearings and other similar purposes.

Wanted—An



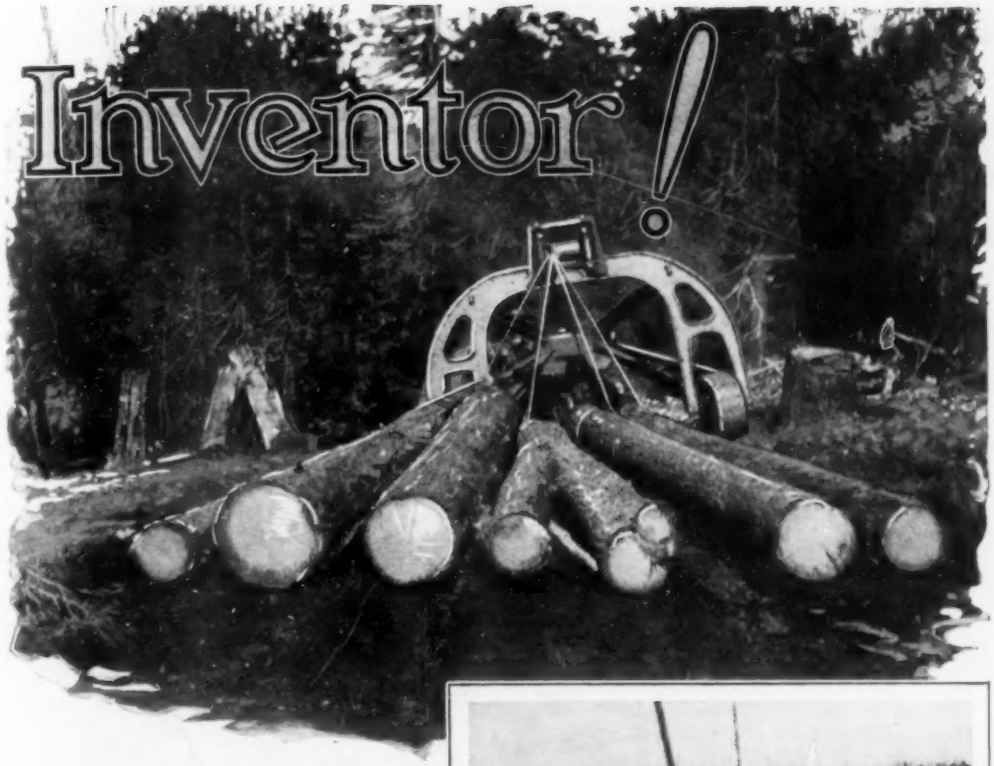
By K. J. WATSON

WILL it be fine fabric, papers of new and desirable qualities, a wood breakfast food, or products to which we can now assign no name?

Timbermen in Oregon and Washington ask themselves this question as they look to scientists to put an end to one of the greatest industrial wastes in modern history.

The Douglas-fir region of those two states, comprising the land west of the Cascade mountains, is one of the last stands of big-league logging in the United States. This 56,000-square-mile area now contains about one-fourth of the nation's standing timber. And every year this region sees one of the greatest bonfires in the country, for the loggers, having taken out the choice timber, set fire to about 3,088,748,000 board feet of sticks ranging from cordwood size up to whole trees, three or four feet through. Of course, the wastage is all in the day's work for the loggers. They can afford to cut only the timber that will pay for itself. They can't afford not to cut, because taxes and carrying costs pile up while mature timber deteriorates. As a result, foresters are seeking new industries that may make lumber sawing almost a subsidiary of woodworking, instead of the principal one it now is in the Douglas-fir district. They see the time when cellulose may be the most important product of logging; when timber will be sawed only for bridge timbers, railroad ties, structural beams and the like; when boards will be of fiber wood with perhaps a veneer of natural wood. But most interesting of all, they watch the development of such products as rayon, the synthetic silk; "glassene"

Felling a Seven-Foot Douglas Fir; the Low Stump Indicates Economy; Below, Tractor Hauling Logs to Loading Point

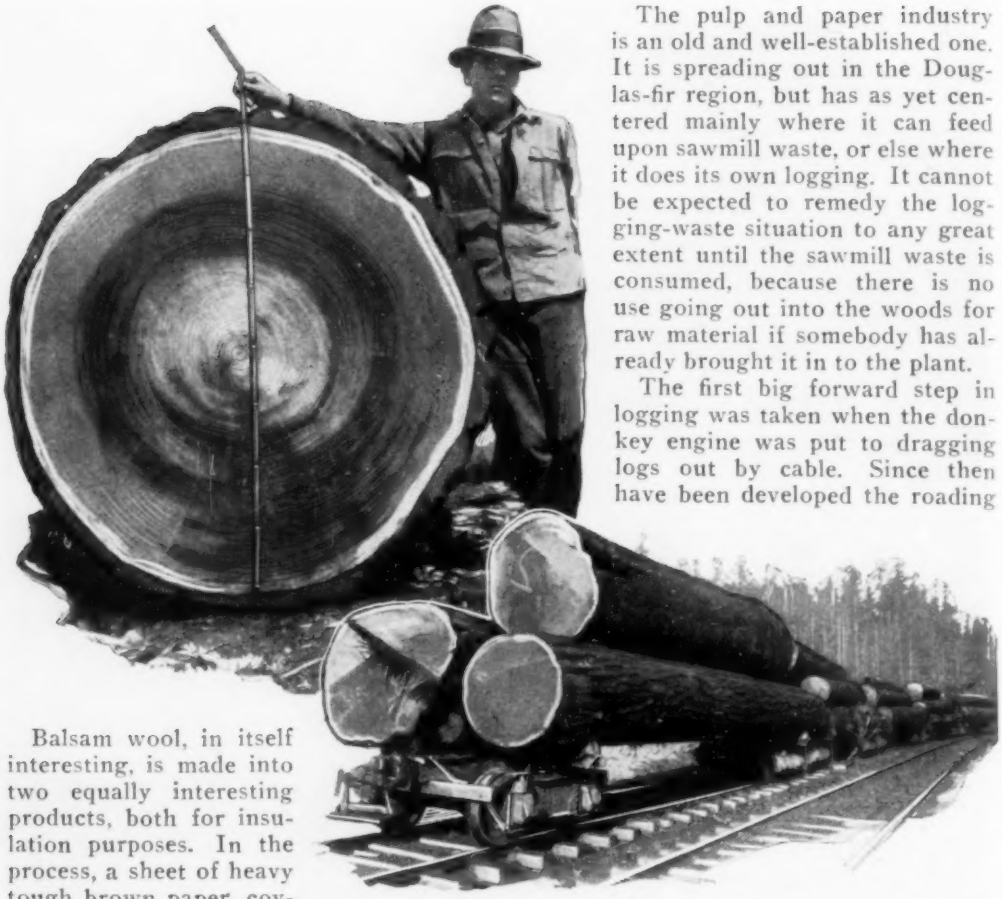


Powered Arch Tractor That Gathers Big Load, and the Wheeled Rig, Forerunner of the Arch

or "cellophane," the celluloidlike transparent paper; balsam wool, the fleecelike wood product highly prized for heat and sound insulation; the expansion of the pulp and paper industry; the production of cowfeed from sawdust.

While there isn't much resemblance between the imitation silk, from which so many dainty things are made, and transparent paper, the basis for both rayon and cellophane is "alpha" pulp, first made from cotton. Chemists have recently discovered that the same alpha pulp can be made from western hemlock, of which nearly 1,000,000,000 board feet is wasted annually in the Douglas-fir region. Cellophane might be mistaken for celluloid at first glance, but it is tough, pliable and burns slowly and with the characteristic smell of wood-pulp paper.

Perhaps most interesting, in the light of the old joke about teaching the mule to eat sawdust, is the fruit of experiments carried out at the United States Forest laboratories at Madison, Wis., cattle feed from sawdust. They actually accomplished it, though the product was not tasty enough to tempt the cattle to any great extent. It was done by converting much of the indigestible cellulose in the sawdust into sugar by cooking in dilute sulphuric acid, the acid being afterward eliminated. The resulting food was a brown meal, one-third to one-half of which was digestible and which had a woody-sweet taste and smell.



Fir Log Damaged by Ring-Scale Fungus, a Common Cause of Waste, and a Big Train of Logs

Balsam wool, in itself interesting, is made into two equally interesting products, both for insulation purposes. In the process, a sheet of heavy tough brown paper, covered with sticky asphalt, is spread out. The wool (the name is the material's best description) falls on it like snow. While the wool is falling, it is sprayed lightly with some sort of glue. When a coating of wool, several inches deep, covers the paper, a similar sheet of paper is spread on top and the whole compressed to less than an inch in thickness. It has found a ready, almost eager, market for heat insulation.

By putting cotton netting on top of the downy wool quilt instead of the brown paper, a highly salable sound-insulation material, used in construction of radio and talking motion-picture studios, is turned out. Both these products are made in Minnesota along with an excellent fiber wood, all from sawdust and trimmings from a sawmill and settlings from a pulp factory.

The pulp and paper industry is an old and well-established one. It is spreading out in the Douglas-fir region, but has as yet centered mainly where it can feed upon sawmill waste, or else where it does its own logging. It cannot be expected to remedy the logging-waste situation to any great extent until the sawmill waste is consumed, because there is no use going out into the woods for raw material if somebody has already brought it in to the plant.

The first big forward step in logging was taken when the donkey engine was put to dragging logs out by cable. Since then have been developed the roading engine, the loader, the yarder, the yarder and loader all in one powerful machine, and now the tractor-drawn arch.

The arch eliminates spar trees and donkey engines, in theory, and has actually done so in some cases. It goes clear back to the first ground-logging methods, though, of course, with vastly improved equipment. Its introduction bears directly and favorably on the logging-waste problem because the machine tends to eliminate destruction of good timber the while it handles logs economically.

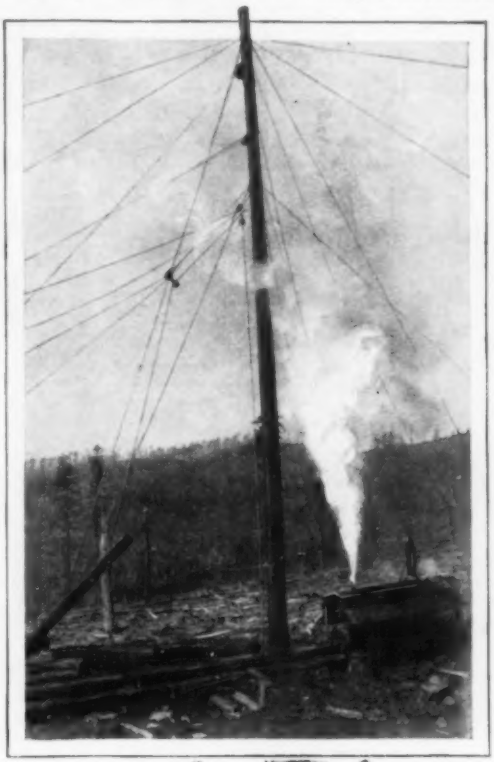
In the horse-logging days, two strong wheels, from ten to twelve feet in diameter and running on an axle which held them five or six feet apart, half carried, half dragged the logs from the woods. One or two teams of horses hitched to a long tongue furnished the power. Logs

were piled, the wheels were backed up over the stack, and a chain was passed under the logs and back to the axle, where it was secured. The long end of the chain passed over a roller on the axle to the horses, which pulled the logs up until as much of the load as possible hung from the axle. That done, the horses were rehitched to the tongue, and away the load went to railroad or mill.

Later, the wheels were strengthened, a tractor replaced the horses, and a drum and wire cable replaced the roller and chain. The formerly straight axle was raised in an arch and a heavy steel rest crossed between the wheels about a foot from the ground. The tractor, fitted with a hoisting drum geared to its motor, pulled the logs to the wheels and lifted their front ends until they rested on the steel crossbar, while the after ends of the logs dragged. That, in a crude way, is the new arch. In this weird-looking device, the giant wheels have given way to broad-tread tractor runners.

The arch took hold first in the pine country of eastern Oregon and northern California because the country is more open and level. Operators in the Douglas-fir region are now showing interest, however. Incidentally, the company has sold the arch and the hoist, made to fit any sort of tractor, to loggers all over the world.

The arch hits at the waste bogie from several directions. By clearing of windfalls, breakage in falling is kept to a minimum, whereas waste in falling sometimes

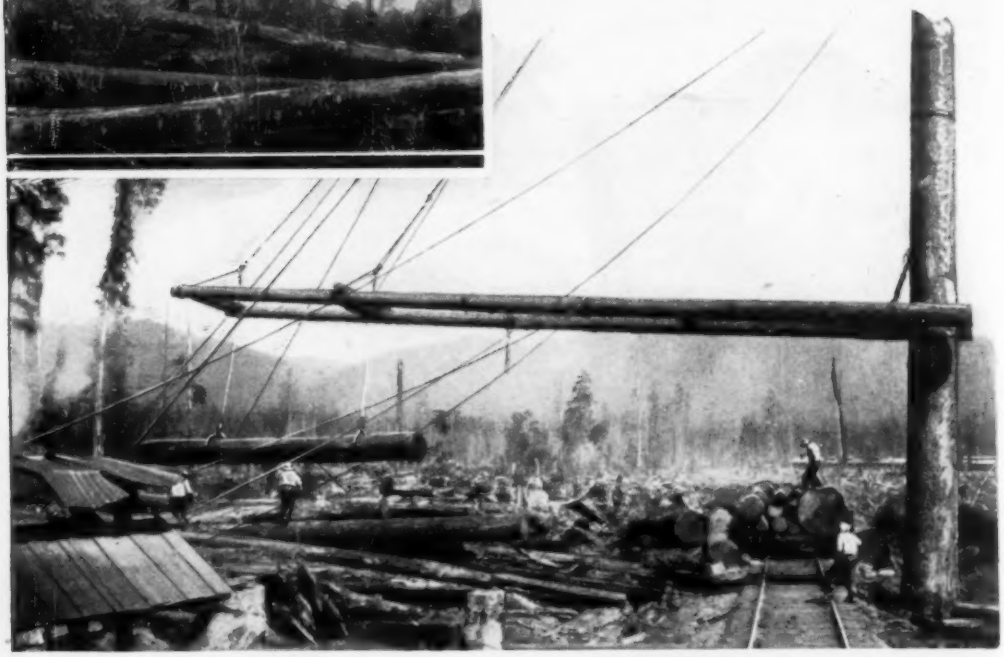


Spar Tree, to Which a Log Is Just Arriving by the High-Lead Method, and, Below, Another View of the Tractor-Powered High-Wheeled Rig for Snaking Logs Out of the Woods

runs to twenty-five per cent without this prelogging. Long logs may be transported without the danger of breakage faced in both high-lead and sky-line methods. The arch yards tree-length logs without damaging them. Smaller, unlogged trees are not smashed right and left as when logs are hitched to a high line. Logs, too small for economical handling by high line, can be yarded at a reasonable cost. Besides these, there are the other important savings in elimination of road-building, moving of high-line tackle, preparation of spar trees and operation of huge engines.

Many loggers are seeking ways out of their waste dilemma, and fuel is an important by-product of lumbering, but most of it now comes from mill waste. Another outlet for sawdust waste is wood flour, which goes into the manufacture of such varied articles as linoleum, unbreakable dolls, dynamite, bakelite, oatmeal and other wallpapers, checkers, etc.

However, regardless of these developments, the tremendous logging waste is bound to go on until the chemist or mechanical engineer finds something to turn the poorer and smaller, or less wanted, logs into products other than lumber. And all signs point to cellulose or pulp as the basis of the utilization, because the condition of the wood, so long as it is sound, makes no difference when the wood structure is to be torn down.

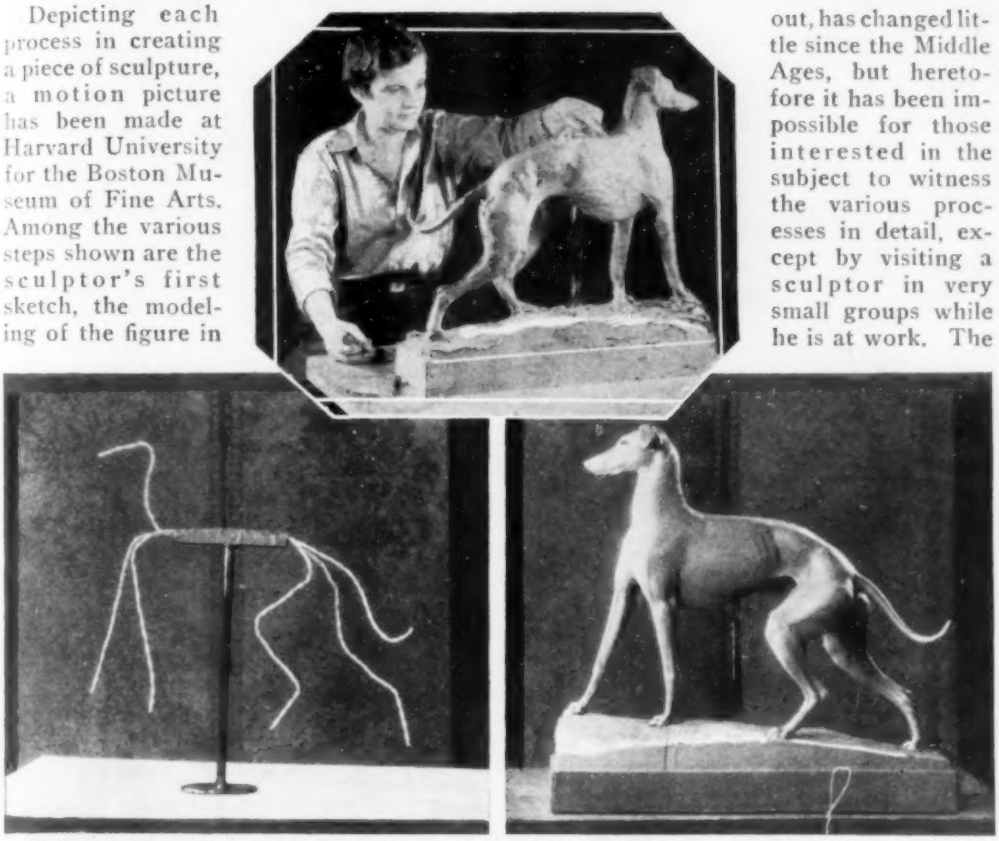


Photos Courtesy U. S. Forest Service

Topper Descending from a Tall Tree after Cutting Off the Top and Branches, and Loading Logs on Cars by a Boom Rigged to a Spar Tree

SCULPTURE IN THE MAKING FROM CLAY TO BRONZE

Depicting each process in creating a piece of sculpture, a motion picture has been made at Harvard University for the Boston Museum of Fine Arts. Among the various steps shown are the sculptor's first sketch, the modeling of the figure in clay, the plaster casting of the model, and, finally, the bronze casting. Included also is a reel on sculpture in stone, showing how figures, particularly animals, are cut in marble. The taking of several scenes was hazardous as there was no possibility of retaking them if an accident occurred. Bronze casting, it was pointed out, has changed little since the Middle Ages, but heretofore it has been impossible for those interested in the subject to witness the various processes in detail, except by visiting a sculptor in very small groups while he is at work. The film offers several dramatic moments as the plaster caster splashes successive layers on the original model, and risks the entire work of the sculptor as he opens the plaster mold. No less exciting is the final moment when the sand mold is flooded with molten bronze at a temperature of 1,900 degrees.

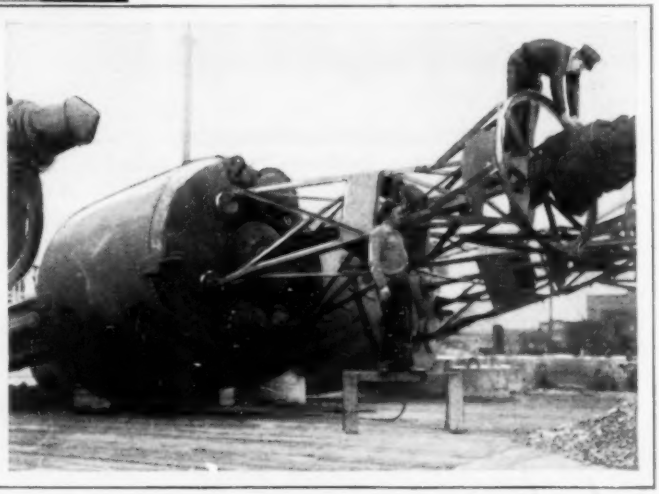


Three of the Steps in Making the Bronze Figure of a Dog; Left, the Wire Frame or Armature; Above, Modeling the Figure in Clay over the Armature; Right, the Completed Work

PAINTLESS AUTOS SEEN NEXT IN RUSTLESS AGE

Automobiles without paint, lacquer or enamel may be developed as the result of the use of stainless steel in motor cars, according to expressions at a recent meeting of the American Society for Testing Materials. Research experts pointed out that it is not visionary to expect that alloy metals can be produced that will allow the manufacture of automobile bodies requiring no finish other than burnishing, and experimenters are trying to give sheet metals contrast values in brilliancy to replace the rainbow hues for which lacquer finishes now are used. Blue for steel and gray for iron are familiar terms, and if metallurgists can produce two-tone or three-tone contrasts that approach lacquer colors in appearance, lacquering and enameling can be dispensed with.

BUOY GIVEN SPRING CLEANING BEFORE TRIP TO SEA



Two Views of Coast-Guard Employes, Giving Spring Housecleaning to a Whistling Buoy Before It Was Taken to Sea to Be Placed in Service

Lighthouse and coast-guard employes, like housewives, have their annual spring-cleaning campaigns, but their efforts are confined to the buoys and other equipment used to signal or warn ships. Recently the huge whistling buoys anchored off the New England coast were given an overhauling at Boston before being taken aboard tenders to be shipped to their locations.

PERISCOPES HIDDEN IN MIRRORS PROTECTED GERMAN "SUBS"

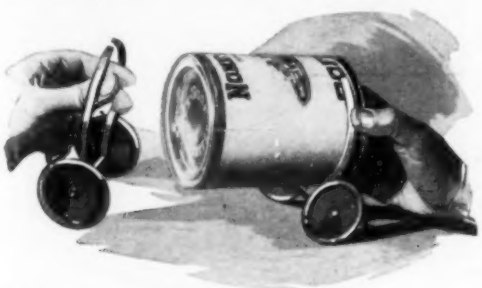
Rifle grenades that bounced in the air before exploding, bomb-releasing cars that hung hundreds of feet below their parent Zeppelins and submarine periscopes, cleverly concealed in mirrors, were among the strange devices used by Germany during the World War, an Austrian engineer has revealed. The mirrors on the periscopes were so arranged that they reflected the waves about them, completely concealing the periscope with the result that the approach of a submarine was difficult to detect. Sliding floats of streamline shape were also placed around the periscope to eliminate the telltale ripples that sometimes revealed the presence of a sub, while deflecting plates on top of the float prevented the rising of a bow wave. Football bladders were placed inside the floats and were filled with water when the boat submerged, to keep them from collapsing. These devices proved so effective that, in some instances, submarines approached within 125 yards of an enemy vessel without being detected, and the report was spread abroad that the Germans were using submarines without periscopes. The bomb-carrying cars from the Zeppelins were lowered on long cables to within a short distance of the ground so that the Zeppelin itself could remain at a safe altitude. The bombs were released by an occupant of the gondola, which was bullet-proof and fitted with a noiseless electric motor, a propeller and a rudder, so that it could be maneuvered about in a wide circle below the Zeppelin. The bouncing grenades leaped into the air due to an auxiliary charge and exploded with greater damage than the usual kind.

FLOWERS ABLE TO TELL TIME DIRECTION AND WEATHER

Certain flowers are able to designate time so accurately by their condition or appearance that it is possible to plant a floral clock where the time of day may be determined in summer by glancing at the garden. The naked-stalked poppy and the copper-colored day lily open at five o'clock in the morning, and within the time to six the morning glory unfolds. At seven comes the African marigold, and at eight, the pink, while the field marigold appears at nine. At eleven the star of Bethlehem opens to be followed by the ice plant at noon. After noon the flowers begin to fold with a regularity similar to their opening. At three the field marigold folds up, to be followed by the African variety at four, and the morning glories an hour later. The common nasturtium goes to bed at six, the naked-stalked poppy at seven and the copper-colored lily at eight. Certain other flowers indicate direction, the sunflower turning toward the sun and the flowers of the compass plant pointing north. The Indian licorice plant predicts weather with remarkable accuracy, being very sensitive to electric and magnetic influences which are reflected in the position of its leaves.

WHEEL SETS FOR EMPTY CANS MAKE TOYS FOR CHILDREN

Wheel sets which may be attached to empty tin cans transform these containers into entertaining toys for the children. The two pairs of wheels are fastened to spring clips which slip over the ends of the cans, making tank cars or toy wagons of them.



Wheel Sets Attached to Empty Tin Cans Transform the Containers into Children's Toys

Coin-in-Slot Bicycle Lock; the Owner Deposits a Coin and Receives the Key to the Lock

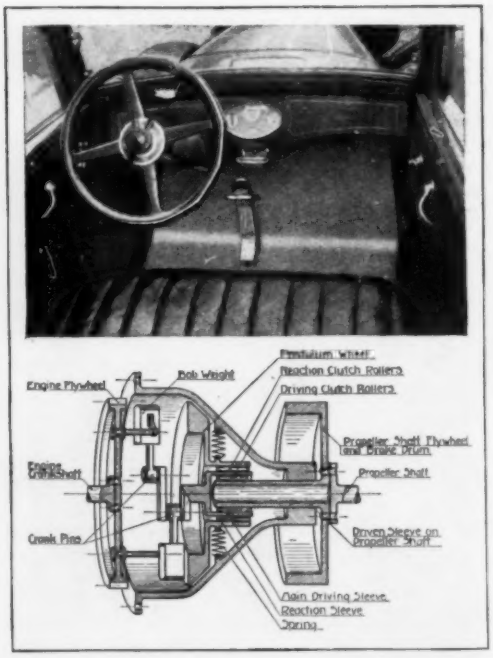
COIN-IN-SLOT BICYCLE LOCKS CHAIN WHEELS TO CURB

Automatic safety locks for bicycles have been installed about some of the public buildings in Berlin, where this mode of transportation is popular. After the cyclist has chained his [illegible] an instrument at the curb, it [illegible] automatically. He then inserts [illegible]oin which releases the key for the lock and retains the key until ready to use the bicycle again.

LOUD SPEAKER FOR CAR DRIVER GIVES VERBAL WARNINGS

Motorists can call warnings to pedestrians or tell other drivers that they intend to turn right or left by the use of a loud speaker for installation in the auto, which recently has made its appearance in Paris. The microphone is fixed in front of the driver who speaks into it in his normal voice. The voice is magnified a dozen times and issues from the loud speaker at the rear of the car.

¶Recent excavations in Rome show that the city had a seven-story skyscraper in the second century A.D.



Above, Gearless Control for Auto Requiring Use of Only One Pedal; Below, Drawing of System

GEARLESS CONTROL FOR AUTO USES ONLY ONE PEDAL

Reducing the driving of an automobile to the operation of one pedal only, a Swedish engineer has invented a gearless control which replaces the usual clutch and transmission. The system has a certain flexibility, obtained through use of centrifugal weights which exert a pull on the crank pins varying with the speed at which the weights are rotated. Alternate weight impulses are transmitted to either the driveshaft or pendulum wheel through driving clutch or reaction clutch rollers. Springs store the reverse impulses carried to the pendulum wheel and react to drive the propeller shaft. At high speed and direct drive, no movement of the intermediate parts occurs, the mechanism driving as a single unit. The propeller-shaft flywheel also serves as a brake drum.

ROBOT RAILWAY CARRIES ROCK TO CEMENT MILL

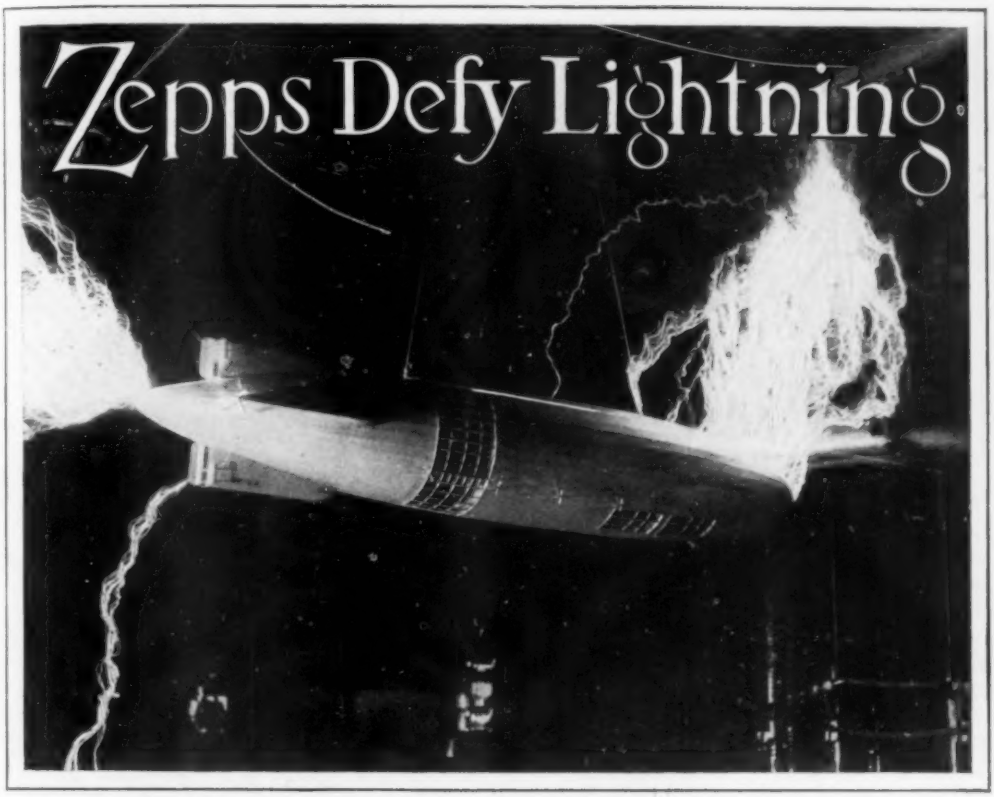
Riderless railway cars which apparently run themselves are used to transfer rock from an excavating pit to a crusher near Dallas, Texas. The secret is a system of remote control for economical operation of the stone cars. Two operators, located where they can view loading and unloading operations and the entire length of line, govern the cars. The track is divided into sections, and the motor-driven cars, each operated by a fifty-horsepower motor, collect energy from the track and a third rail. Switches before the operators control the flow of energy for each section of track. The cars are stopped by interrupting the flow of electricity to a particular section, electric brakes, operating automatically when current is shut off, serving to stop the vehicles. The direction of travel may be changed by throwing a switch. On downgrades gravity does not speed up the cars, but this energy is automatically converted into electricity and passed back to the line to run other cars.

"WALKING" HORSE ON ROCKERS GETS POWER FROM RIDER

Suitable for either a toy or for exercising in the home, a walking horse on rockers derives its power from the rocking motion furnished by the rider. It it similar to ordinary toy rockers, except that there is a separate rocker for each leg, and the legs themselves are pivoted on a spindle through the body. When rocked, the steed forges slowly ahead and direction is controlled by pulling on the reins. Sizes suitable for children and adults are made.

Walking Horse on Rockers Which Gets Its Power from Rocking Motion Supplied by the Rider

Zepps Defy Lightning



Photograph of Model of Commercial Airship in High-Voltage Test; Note the Large Number of Electrical Discharges at Right End of the Model; Framework and Covering Act as Protecting Shield

By HENRY HOYLE

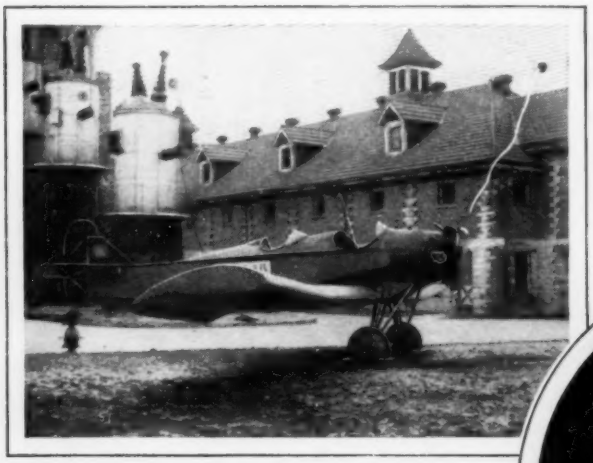
LIGHTNING, one of nature's bad boys, has long been accused of being a firebug. There is little argument about its setting fire to buildings, trees and other things when conditions are just right, but when it comes to aircraft, the guilt is not so obvious.

Arthur O. Austin, who is studying the subject of the lightning hazard in flying, and performing numerous tests at the world's most powerful outdoor high-voltage laboratory, in Barberton, Ohio, has been finding out much about the fire-making abilities of lightning.

Is a lightning discharge likely to fire the fuel tanks of an airplane? Will the fabric of a plane or dirigible be ignited? If so, will it continue to burn? Can a lightning bolt damage sheet duralumin or aluminum sufficiently to cause trouble to the plane or airship? These are some of the questions that he is investigating.

At the Goodyear-Zeppelin air dock and factory a few miles from the Barberton laboratory, Dr. Karl Arnstein and his men are designing and building Zeppelin airships. Although non-burning helium gas is to be used in the cells of these dirigibles, the problem of avoiding fire is not being neglected.

A model of a commercial airship of 6,500,000-cubic-feet helium capacity was turned over to Mr. Austin for test purposes. This model was subjected to two kinds of man-made lightning. It first was bombarded with a stream of giant sparks. Then it was subjected to single impact discharges of great power. The ship came through none the worse for its treatment except that the fabric covering was scarred where the discharges had entered or left. Dr. Arnstein, commenting on the tests, said: "The metal framework of those ships acts as an excellent con-



ductor of lightning, protecting the vital parts, such as the gas cells, the passenger compartment, crew quarters, engine room and fuel tanks which are located inside the metal structure. The outer cover which, on the Zeppelin-type ship, is of doped fabric, and is not called upon for retention of the buoyant gas, does not sustain combustion. Lightning strokes leave only very small local singed traces at the points of entry and exit."

In the past, rigid airships have been struck by lightning. In some instances, slight local damage, such as the fusing of a metal part, was caused; but it in no way interfered with operation of the ship. In most instances, the only marks left by the lightning on the airship were at the points of entrance or exit of the discharge.

"Experience with scores of Zeppelin ships, all of which were inflated with hydrogen, has shown that the rigid metallic, fabric-covered airship is perfectly safe from lightning," Dr. Arnstein continued.

"In spite of the fact that the highly inflammable hydrogen was used, the Zeppelin company built and operated 115 airships, none of which were lost during flight by fire except the 'L-2' and 'L-10,' and, of course, those brought down in war. The 'L-2' was burned during a trial flight due to hydrogen finding its way into a power car while the motor was backfiring. The 'L-10' was struck by lightning while valving gas."

Mr. Austin has shown that there is practically no difference in the effect of lightning on a dirigible and a plane of similar construction, as far as igniting the fabric is concerned. A Barling "NB-3" monoplane, provided by Popular Mechanics Magazine, at whose request these tests were started, was bombarded by impact discharges of artificial lightning. In

Barling Monoplane Being Struck While Motor Is Running and Cone Raised on Duralumin by Stroke of Artificial Lightning

no instance was the fabric or other part of the ship set on fire. This plane has a well-bonded duralumin framework over which a doped-fabric cover is placed, being similar to a Zeppelin in that respect. The discharge always entered the plane at some point in the metal structure. If the fabric happened to cover this metal, the intense heat of the flash would instantly vaporize the fabric, producing a small hole, in some instances as large as a lead pencil. This hole was not burned, there being practically no evidence of scorching. It was caused by the "explosion" or instant vaporization of the fabric.

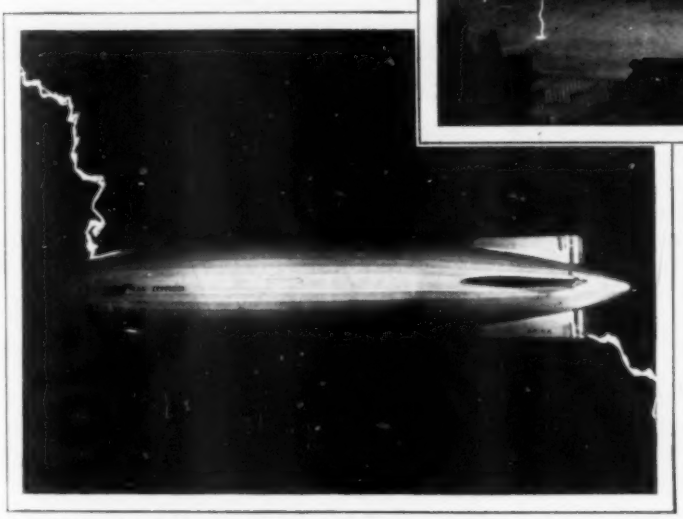
"During an electrical storm," Mr. Austin said, in discussing the tests, "a stroke of lightning appears as a single discharge, whereas it may, as a matter of fact, consist of a number of discharges in rapid succession. The heating effect of several strokes may be much greater than that indicated by the maximum current developed in a single discharge.

"When lightning passes between two

metal surfaces where the heat generated cannot escape readily, burning of the metal results.

"The tests indicate that where surfaces are free or open, the fire hazard is apparently small. This has been borne out by the experience of dirigibles, and in general observation of the performance of lightning.

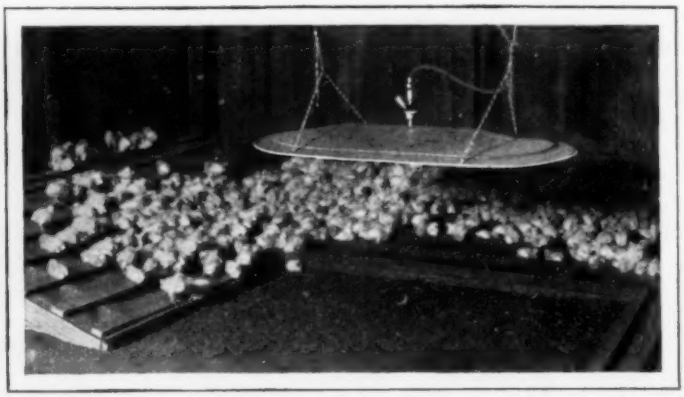
"To test the effect of poor contacts between metal, a strip of duralumin was laid on another sheet of the same material. This arrangement is, roughly, the same as that occurring in an airplane where a poor joint exists. When the set-up was subjected to discharges, it was found that considerable burning had occurred. In practice, the riveting of the parts together tends to insure a contact and reduce the danger of a hot spot to a minimum. I believe that the only cases where metal has been damaged in large dirigibles has been at points of poor contact. The present method of construction, of carefully bonding all parts in dirigibles and airplanes, should make this hazard negligible.



Two Interesting Laboratory Tests at Barberton Plant of the Ohio Insulator Company; the Model Commercial Airship Is Withstanding 1,250,000 Volts

"The previous tests upon airplanes indicate that it is comparatively easy to localize the point of discharge by providing a small lightning rod or even a bead of bare metal which covers the corners at points where lightning is likely to strike. These points include those at wing tips, rudders, elevators, landing gear, the nose of the plane and propeller. The research has shown also that it is comparatively easy to test joints to determine their lightning-proof qualities by placing them in the path of discharge."

Some airplane designers have held the opinion that the fuel tanks are a source of danger when the craft is in a lightning-infested region. Mr. Austin has demonstrated that no such danger need exist. During all of the tests on the Barling, there was fuel in the gasoline tanks. In some of the experiments, the engine was running; yet no explosion took place. About the only way in which fire could be started would be ignition of gasoline vapors that had collected in a pocket. It is, however, a simple matter to protect these parts by creating shunt paths through which a discharge will travel.



Movable Gas Brooder Which Is Placed over Roosts to Coax Baby Chicks off the Ground as Soon as They Are Old Enough

MOVABLE GAS BROODER COAXES BABY CHICKS TO ROOSTS

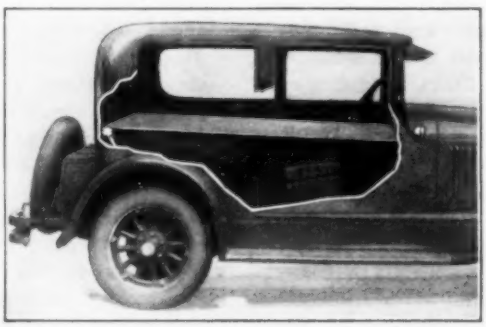
Because he had trouble in coaxing baby chicks to go away from the heat of the brooder when they reached roosting age, a California poultryman invented a movable gas brooder with which he takes the heat to the roosts to induce the chickens to leave the ground. The oval brooder is of galvanized iron, lined with asbestos and iron plates, and is equipped with chains for suspending it at any height. Gas connection is made with rubber tubing and the larger heaters are provided with thermostats. The movable brooder does away with most of the crowding and subsequent mortality among the chicks by thus luring them to roosts.

DEAF HEAR ELECTRIC WAVES BY TOUCHING WIRE

Working on the theory that human beings can be made to hear not only by a reception of sound waves, but by contact with electric vibrations or waves produced by a microphone, two Vienna scientists recently demonstrated an apparatus which, in effect, is an artificial eardrum enabling deaf persons to hear by means of electric waves transmitted to the brain direct through the auditory nerve. In the tests, a phonograph record was played in one room and the sound waves were transformed into electric vibrations which were carried by wire to another room. There deaf persons were able to hear the music merely by touching the wire to the ears. Sound waves cause the eardrum to vibrate and incite the brain nerves which results in hearing, and the apparatus apparently accomplishes the same result with the electrical waves. At present the apparatus is complicated and dangerous, because the sounds, after conversion to electric impulses, are greatly amplified.

FOLDING BED FOR MOTOR CAR FITS BEHIND REAR SEAT

Comfortable sleeping quarters for the automobile are provided with a folding bed which, when not in use, may be tucked away behind the rear backrest. The bed consists of a heavy canvas suspended by two steel tubes. The rear tube serves as a roller in tightening the canvas with a ratchet device and the front tube is hooked by two chains to connections installed on the dash plate. The rear backrest is removed for installation, and the canvas bed fits behind it when traveling. By placing the rear backrest on top of the rear cushion when making up the bed, the comfort of a spring bed with mattress is given. The bed is suitable for cars having front seats with folding backs, or detachable front seats. For cars with rigid front seats, a bed with a frame is provided which rests like a cot above the seats, the outfit folding into a compact bundle when not in use.



Heavy Canvas Folding Bed for the Automobile

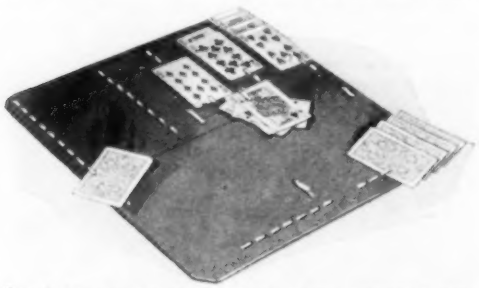
Miniature Monoplane Powered with a Model Gas Engine, Built and Flown by Junior High-School Students; the Ship Is Equipped with Automatic Controls for Taking Off and Landing

MINIATURE PLANE IS POWERED WITH MODEL GAS ENGINE

Junior high-school student members of an aviation club at Pasadena, Calif., have built and flown a miniature monoplane powered with a three-quarter horsepower model gas engine. The plane is equipped with set controls, the apparatus being set for flight and landing, so that, if the ship crashes, it will be due to an accident or defect in the mechanism.

BRIDGE BOARD WITH CARD CLIPS FOR OUTDOOR GAME

Playing bridge outdoors, on boats, trains or in other places where breezes blow, is facilitated with a board provided with clips for holding the cards in position. It folds so that it can be carried easily under the arm. Metal clips about the edges protect every move, from the deal to the assembling of tricks, against breezes that might blow the cards away.



Board for the Outdoor Bridge Game, Provided with Clips to Hold the Cards in Position

NOISES IN STREET CAR REDUCED WITH TROLLEY CUSHION

Unpleasant noises from moving street cars are said to be greatly reduced by using an improved cushion device at the base of the trolley to curb the vibrations that originate in the wheels and often communicate themselves to the car top and the trolley with disturbing results to the passengers. The cushion is composed of two concentric steel tubes separated by a layer of special rubber. Current is carried by means of a copper connection between the two tubes. Rubber already has been employed as a silencing agent, but in the usual installation it becomes so tightly compressed under the trolley base that it loses its resiliency and hence its sound-deadening qualities.

¶Those wishing further information on anything described in the editorial pages can obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.

ARMY PIGEONS ARE TURNED INTO PHOTOGRAPHERS

As a result of the important part played by carrier pigeons in the world war, German army officers recently have started extensive training of the birds and experimenting with them. Some have been taught to carry an automatic camera strapped to their breasts, the apparatus being capable of making six exposures while the birds are on the wing. Dogs are being trained with the birds, the animals bringing the birds in carriers strapped to their sides from the home port of the pigeons to officers whom the dogs have been taught to follow.

Above, Dog with Case Containing Carrier Pigeon Strapped to Its Back; Right, Carrier Pigeon with Automatic Camera Mounted on Its Breast

OIL MEN TAME WILD GUSHER WITH SPECIAL NIPPLE

After a battle lasting for eleven days, oil men recently succeeded in taming "Wild Mary," one of the biggest oil wells ever to go on a rampage in the Oklahoma City field, with a special nipple. When the gusher first blew itself in at 6,500 feet, it produced nothing but gas, but soon started flowing oil. Well fighters were rushed to the scene by airplane, and, at first, it was decided to cut threads on the upper part of the seven-inch drilling nipple and attach master gates and crosses. Workmen, wearing steel helmets and slickers, attempted the job, but were unable to cut the threads correctly and the nipple burst, the sand accompanying the oil and gas quickly cutting away the pipe, once an opening was started. Another unsuccessful effort was made to place a second type of control gate in position; then field engineers made an outside cutting nipple or die, containing only outside threads made from high-grade hollow steel billets, tempered and heat-treated after the dies were cut. This capped the well and stopped its spree. About half the oil was saved from pools around the derrick, but the rest was lost in spray which extended for twelve miles, forcing the closing of many wells and the removal of families. In addition to helmets and slickers, men working at the scene wore cotton in their ears to shut out the roar. The gusher cost about $75,000 a day during its rampage, not including property damage.

BRICKS THAT INTERLOCK LAID WITHOUT USE OF MORTAR

Bricks that dovetail and interlock and that are said to form a wall stronger than can be built with the usual kind, are laid without mortar. An angular ridge in the center of each brick fits into a corresponding groove in the one above it, so that no mortar is necessary to hold the units together.

GOLD MINING IN THE PHILIPPINES

The Philippines and their 7,000 islands, of which only about 2,500 yet have names, are seldom regarded as a source of mineral wealth, but, since 1914, considerable quantities of gold have been taken from Masbate, a mountainous island, about 1,800 square miles in area. Low-grade ores, dumped and abandoned as worthless by the Chinese, who did extensive mining here in the twelfth century, have been made to yield profits with the aid of modern mining machinery and methods and new properties have been developed. In one district, the rock assays from $2 to $6 a ton and is easily broken up for the gold extraction processes. The miners are not without their troubles, however. Timbers have to be selected of special woods, as the white ants devour ordinary varieties, and dynamite has to be specially guarded against theft by the natives, who use it in killing fish. Bullion is shipped to the bank at Manila for later transfer to the United States.

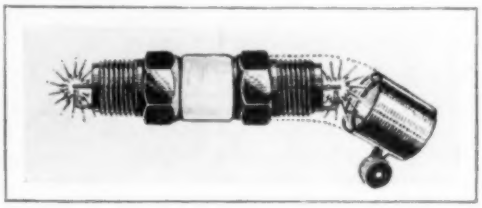
Lightship, Weighing 150 Tons, Being Lifted aboard Ocean Liner with Derrick; Note the List of the Larger Vessel Caused by the Load

SHIP HOISTED ABOARD VESSEL WITH BOAT'S DERRICK

Hoisting one ship aboard another by means of the derrick of the larger vessel recently was accomplished at Liverpool, England. A lightship, weighing 150 tons, was to be loaded aboard the S. S. "Belpamela" for shipment to the Persian gulf, and the feat was done by using the crane to pick the lighter boat out of the water and place it on the deck of the ocean vessel. The big boat listed as the lightship was raised, but the job was done without trouble.

SPARK PLUG HAS DOUBLE HEAD AND IS REVERSIBLE

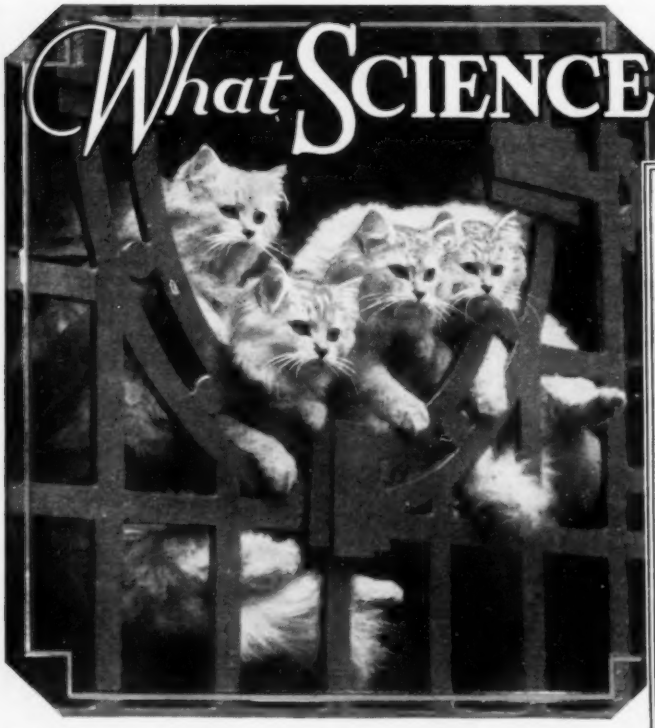
Made so that either end can be used in the motor, a reversible spark plug with a double head now is on the market. The metal cap on the top head covers the upper end, making the plug dust-proof, and also is carrying the screw and nut for the ignition wire.

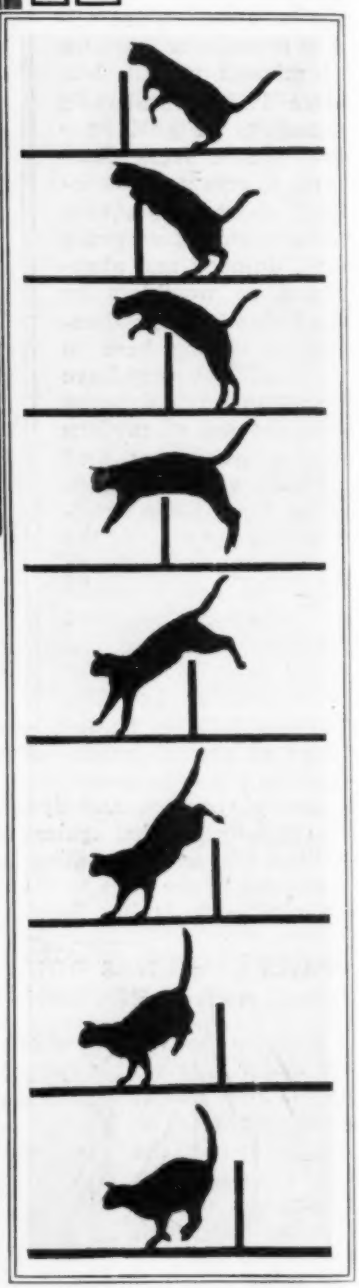


Reversible Spark Plug with Double Head; Either End Can Be Used in the Motor

¶Some clouds are ten miles thick.

What SCIENCE KNOWS





Prize Kittens, and Silhouette "Movie" Showing How the Cat, One of Nature's Most Remarkable Animals for Strength, Agility and Endurance, for Its Size, Jumps over a Fence

By MILTON FAIRMAN

CATS live in a colorless, toneless world, according to Dr. Georgina Stickland Gates, of Columbia University, who spent years in studying felines. As a result, much has been learned regarding the family tabby.

Early experimenters believed cats could distinguish colors. An elaborate test gave decisive results. A series of glass jars, each covered with paper of a different color and each made to smell of fish, were used. A small fish was placed in a red jar. After investigating each receptacle, the cat slowly learned that the red one had the fish. This seemed conclusive proof that she could distinguish colors.

The investigator, however, was patient. A certain shade of gray was finally selected for the other jars. The cat was completely baffled. She could not tell this gray from red. Tests showed that it was of the same brightness as the red. Thus it was proved that, although cats respond to varying degrees of brightness, they are color-blind.

Twilight is then the world of the cat. She cannot even recognize differences in facial expression, and objects are but shadowy outlines to her. She lives in a world like our own at dusk, and then her sight is keener than man's. An old legend says that the Chinese once told time by the size of the pupil of the cat's eye. Tests have

About YOUR CAT

shown it capable of great expansion or contraction. Contrary to popular belief, she cannot see any better than man or any other animal in pitch darkness. However, her whiskers enable her to "feel" her way about.

Her fear of water is traditional. This has been disproved by observers. They point out the frequent attacks on the fish bowl, and cite cases of cats diving for fish. Fishing cats are, however, the product of wharves or mills. Scientists explain that they learned to fish in this manner:

Chasing a rat along the wharf, Puss finally followed it into the water. Since she is attracted by any small moving object, a fish, swimming near the surface, later claimed her attention. She stalked it, and suddenly sprang upon her prey. Thus she overcame her fear of water. So Tabby's shyness near water is largely a bluff; she can, in time, become accustomed to it.

Cat fanciers were once of the opinion that their pets might have learned to fish by imitation, but one scientist placed two cats in adjoining compartments separated by a wire screen. Cat A watched cat B escape by pulling a cord to reach bait outside the cage. The experiment was repeated time after time, but A was unable to repeat the actions of B, although she carefully observed them. In another test, two cats climbed a pole to reach a fish, but a third cat, hungry and able to climb, witnessed the experiment repeatedly without learning how to reach the food.

In another test, a cat was placed in a box, escape from which might be gained by pulling a string. the cat struggled wildly. Eventually, by accident, she clawed at the cord and was freed.

Placed in the box again, experimenters

Top to Bottom, "Shadow Lassie," a Blue-Ribbon Winner; Cat and Dog Tricksters, and a Champion Siamese Cat

found that Puss' previous experience had taught her nothing. Finally her struggles brought about her freedom. After repeated experiments, the subject was still unable to free herself directly, but the time of confinement gradually decreased. Puss learned a lesson, not by reasoning out a means of escape, but by association with the cord as a step toward freedom.

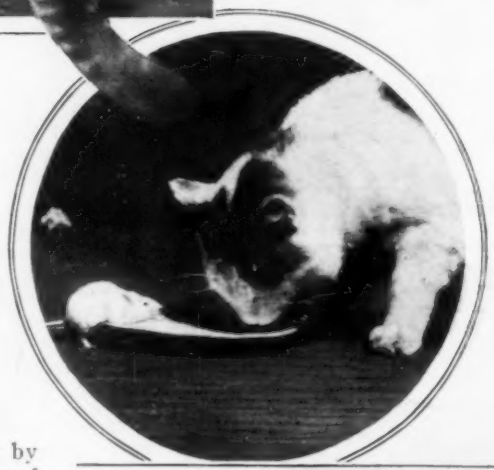
An investigator taught a kitten to answer a signal, "I must feed these cats," by climbing up for food. Sixty trials were required for the lesson. Later, he tried "I will not feed them" as a signal that there was no food. Not until after 380 trials, did the kitten seem able to distinguish between one signal and the other.

Tradition has it that a cat cannot be lost. Stories of unwanted cats who returned home despite the efforts of their masters to be rid of them are many. And, so far, this feline faculty has baffled experimenters. One cat was taken in an open boat to the center of a lake. The oarsman continued to turn the boat in circles, but Puss was always able to turn her head toward home and cry.

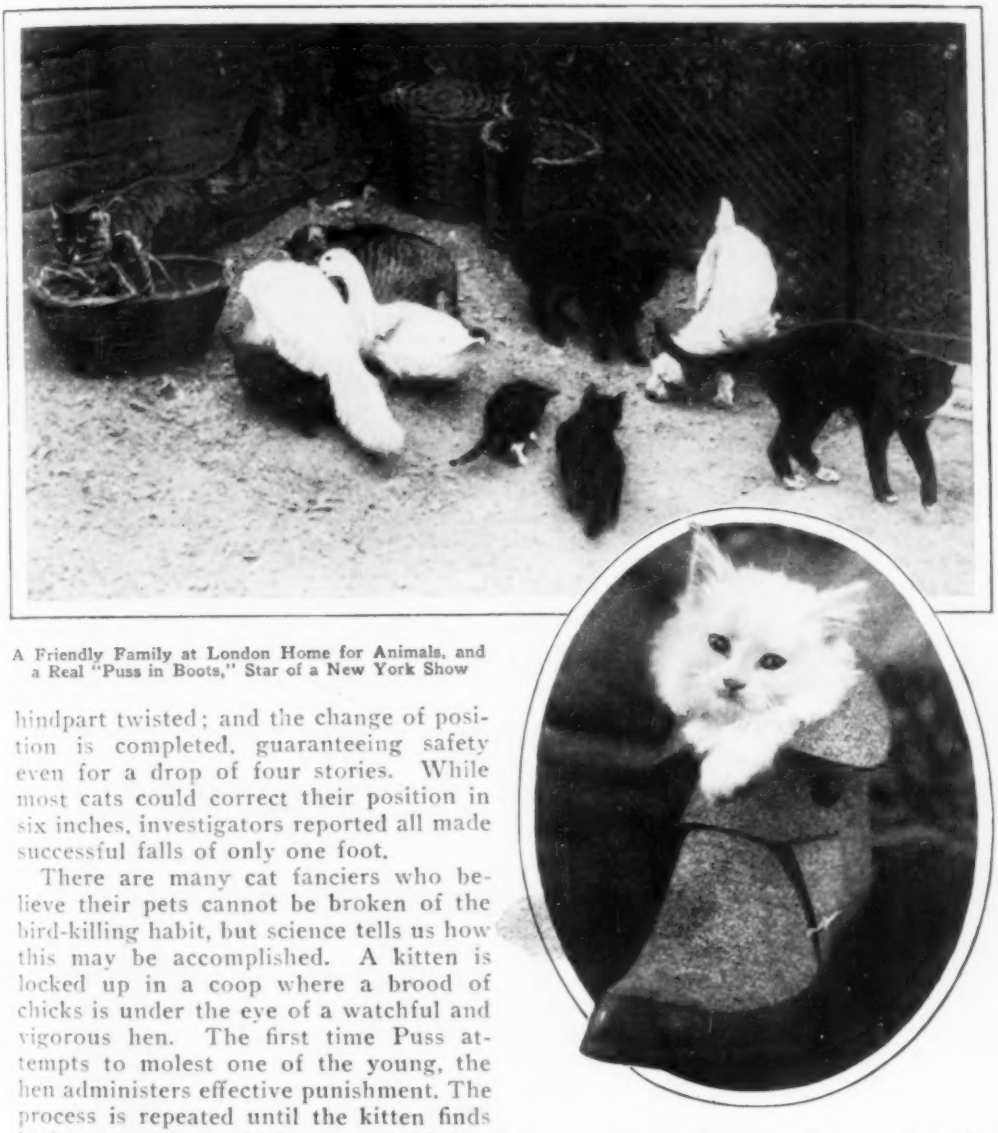
Science has but one explanation to offer for this rare faculty. The cat has some mysterious equipment which acts as a compass and enables her to retain her sense of direction. This "compass" operates independently of vision, hearing, or smell, and is apparently a muscle sense.

The old fable of the cat's nine lives was largely due to her success in escaping injuries in long falls. Experimenters put Tabby through a series of trials before a camera and learned some surprising things about her. For instance, if you drop your cat, head forward, a foot from the floor, she will be able to correct her position and land on her feet.

The camera revealed the process: First the forelegs are contracted, and the front of the body rapidly twisted; then the hindlegs are contracted, and the



A Cat That Sounded a Burglar Alarm on Knocker; Friendly with a Mouse, and Diagram Showing How Cat Twists to Land on Its Feet



A Friendly Family at London Home for Animals, and a Real "Puss in Boots," Star of a New York Show

hindpart twisted; and the change of position is completed, guaranteeing safety even for a drop of four stories. While most cats could correct their position in six inches, investigators reported all made successful falls of only one foot.

There are many cat fanciers who believe their pets cannot be broken of the bird-killing habit, but science tells us how this may be accomplished. A kitten is locked up in a coop where a brood of chicks is under the eye of a watchful and vigorous hen. The first time Puss attempts to molest one of the young, the hen administers effective punishment. The process is repeated until the kitten finds it best to leave chickens—and birds—alone. The lesson is never forgotten.

In testing the value of immediate punishment as a corrective, one experimenter placed a bowl of ice water in a box which usually contained clothing. The finery had been damaged often, and punishment had failed to keep Puss from the box. This time, the effect was so immediate that Puss was forever cured of leaping into the chest.

One curious feline trait was noted by Hans von Hentig. Before earthquakes, they draw back their ears and bristle their hair, while their eyes glitter and bodies tremble. Von Hentig believes that the cat is sensitive to those ground disturbances which precede an earthquake.

PLAYGROUND ON HOTEL ROOF HAS FISH POND

To establish a healthy spot where children of guests might amuse themselves, the Prince George hotel in New York has turned its roof into an aerial playground. It contains an artificial lake with live fish, sand piles, dollhouses and games.

Extension Frames in Front of Fenders Aid the Motor-Coach Driver in Judging Clearance

VISIBLE FENDERS GUIDE DRIVER IN CONGESTED TRAFFIC

Berlin busses are being equipped with extension frames above and outside the fenders high enough to enable the driver to see them. The fender protectors show the driver the clearance his bus has and aid him in judging distance in narrow lanes of traffic on congested streets.

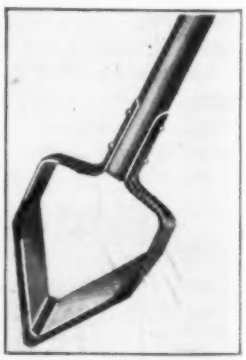
LOCK GUARD THAT HOLDS KEY FOILS THIEVES

Thieves who often gain entrance to a home by pushing a door key out from the outside, and then picking the lock, can be foiled with a lock guard which holds the key in position. The guard consists of a hooked piece of metal, the hook being attached to the doorknob, and the metal end inserted in the ring in the door key, the guard preventing the key from being pushed out of the slot.

SPRAY DUST FROM MOTORBOAT TO CURB MOSQUITOES

Equipped with an electric blower, an outboard-motor boat has been used successfully by the United States Public Health Service to spray poison dust over the surface of still waters to kill mosquito larvæ. The method was first practiced with the aid of airplanes and hydrogliders operated by air propellers, but it was found that slower speeds were more effective, and, furthermore, the little outboarder could be operated with but one man. The dust, paris green mixed with lime, is distributed over the water by the blower from a specially constructed hopper, which permits control of the dust without throttling the ingoing air supply. Extensive tests have been made on the surface of Reelfoot lake, in Tennessee, a shallow body of water where mosquitoes breed in great numbers. Using three-fourths of a pound of poison to the acre, larvæ were killed 450 feet from the point of liberation. A boat speed of five miles an hour was found sufficient.

PUSH HOE FOR GARDEN WORK ALSO USED AS SPADE



Somewhat resembling a pointed plowshare, a push hoe for gardening has many uses for which the ordinary chopping hoe is unsuited. Its pointed cutting edge adapts it particularly for weeding around small plants, and it also may be used as a spade, for furrowing and marking, for edging and trimming lawns, and, in the winter, for cleaning ice from sidewalks. The blade has more than six inches of cutting surface and the tool is operated by pushing.

PLANE LANDS ON MOTORBOAT AT FORTY-MILE SPEED

Nosing Down for Descent on the Motorboat Deck; While the Boat Was Speeding at Forty-Five Miles an Hour, the Plane Alighted on Its Deck and Flew Away Again without Mishap

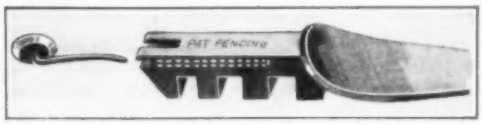
The ease with which small planes may be maneuvered has again been demonstrated with a powered glider at Long Beach, Calif. The tiny plane landed on the deck of a motorboat speeding at forty-five miles an hour and took off from the same space without mishap. The test required close co-operation between the glider operator and the pilot of the boat. The motorboat's deck was only twelve feet long.

CHROMIUM FOUND IN MONTANA

Chromium, one of the hardest of metals, which in recent years has been in wide demand because it gives to steel added strength and the ability to resist abrasion, now is being produced in Montana. Chrome-ore deposits have been found near Yellowstone national park at an altitude of 8,000 feet, and mining equipment, including a portable air compressor, was dragged on skids through deep snow up the mountain side to make available the precious metal. Although chromium was discovered more than 125 years ago, it was used mostly in the chemical industry until recent years when its application for stainless steel and chromium plating for automobiles suddenly brought a great demand for it. Because it will not oxidize when heated to a high temperature, it is especially useful in electric-heating equipment, as well as for high-grade steel cutting tools.

WHEEL ON GLASS CUTTER IS EASILY RENEWED

Refills for a glass cutter are made quickly with a type of cutter containing a "stick pin" wheel. The wheel, or cutting element, is mounted on a pin at right angles to it which wedges solidly into the head of the cutter. To change wheels, the old one is simply pulled out and a new one inserted.



Glass Cutter with Removable Cutting Wheel

Design of Modernistic Restaurant, Built atop a Column Which Revolves with Diners or Sight-Seers

RESTAURANT BUILT ON COLUMN REVOLVES WITH DINERS

Among the modernistic building designs prepared by architects for submission to the Chicago World's Fair Centennial committee is that of a revolving restaurant mounted on a huge column. The structure is spiral in effect with promenades and space for indoor and outdoor dining rooms. Both building and column revolve once each half hour, thus affording an opportunity for sight-seeing while dining or strolling on the platforms. The model provides space inside the column for elevators, while at the base are foyers and a space for parking of automobiles.

EARTH IS AHEAD OF SCHEDULE IN ITS ROTATION

Through observations on eight different bodies in the solar system, scientists have obtained proof that the earth is ahead of schedule in its rotation, and hence is not quite reliable as a timepiece. For some years it has been suspected that the earth is not exactly regular in this respect, and at one time scientists attributed this to a shrinkage of its diameter. Dr. Ernest M. Brown, Yale mathematician, however, says observations over many years indicate some sort of order in this irregularity. At present the earth is running ahead a fraction of a second a day. It appears to lag for a certain number of years, then to speed up for a like period. There were changes in its rate of rotation in 1897 and 1917, and the rate probably will change again in the next few years. At first the changes were attributed to the moon, but observations of the sun showed the same variations, indicating that the earth, rather than the moon, was in error, and these were borne out by studying other planets, so that now the changes in speed of rotation are accepted as fact.

LIGHT SCHOOL IN SKYSCRAPER AIDS HOME MAKERS

Better ways to illuminate homes, offices, factories, airports and other places are shown in a school established by the Chicago Lighting institute on the thirty-sixth and thirty-seventh floors of the Civic Opera building. To demonstrate proper home lighting, a six-room bungalow has been installed, fitted with the newest ideas in fixtures and displaying methods of direct and indirect lighting. How colored patterns of light are projected on the walls and ceilings is illustrated. A special feature of the institute is its two-story auditorium, seating 225 persons. The stage is set with a replica of a modern city, which is illuminated by various methods of flood and special lighting.

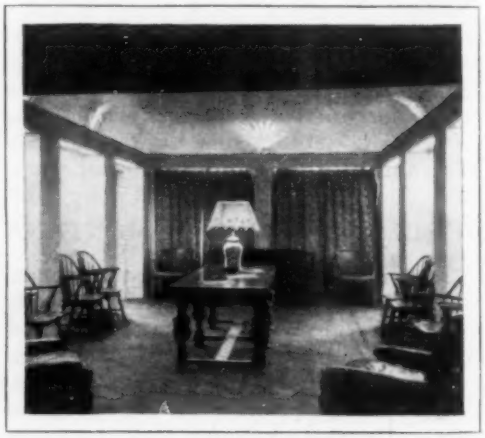


Exhibit Room in the Chicago Lighting Institute, Showing Installation of Ceiling and Wall Illumination

Automobile Tire, Suspended between Goal Posts, Serves as a Target for University of Nebraska Football Squad, Aiding Them in Developing Accuracy, Particularly in Practicing Forward Passes

AUTO-TIRE FOOTBALL TARGET DEVELOPS ACCURACY

To aid football players in developing accuracy in tossing forward passes, a coach at the University of Nebraska has rigged up an automobile tire as a target. The tire is suspended between the goal posts, and players engaging in summer practice attempt to throw the pigskin through the tire. A point system gives credit for bull's-eye shots from various distances and angles.

GROWTH OF PLANTS IS FASTER UNDER NEW GLASS

Corn, wheat, tomato and other plants grow much faster and absorb greater quantities of nitrogen when raised under certain glass substitutes than under ordinary glass, tests at the University of Wisconsin have revealed. In the case of corn and wheat, the increased nitrogen consumption is from ten to fifteen per cent greater, and the substitute glass material produces a temperature from one to two degrees higher than the plain glass. Plants raised under the special glass are not so hardy as the others when removed and exposed to light frosts, but they contain more fatty substances and more nitrogenous compounds. Some plants grown underneath the substitute glass, which contains a high percentage of quartz, show a longer ripening period.

ELECTRIC GRINDER AND SANDER WITH FLEXIBLE SHAFT

Equipped with a flexible shaft, an electric sander also contains attachments for grinding and filing. The disk for sanding is attached to a length of flexible metal tubing, allowing a comfortable position for working, and the entire machine rests on rollers and so is easily portable. Different tools may be operated at different speeds and the motor is set on vertical and horizontal swivels to allow still greater freedom of movement. The base of the apparatus can be equipped with a clamp for grinding tools, and a tool tray also is provided for the convenience of the worker.

What the Clouds

Thunderheads in Colorado; Every Cloud in This Photograph Is the Top of a Separate Column of Air; Gliders Could Utilize These, but There Would Be Lightning and Wind Hazards

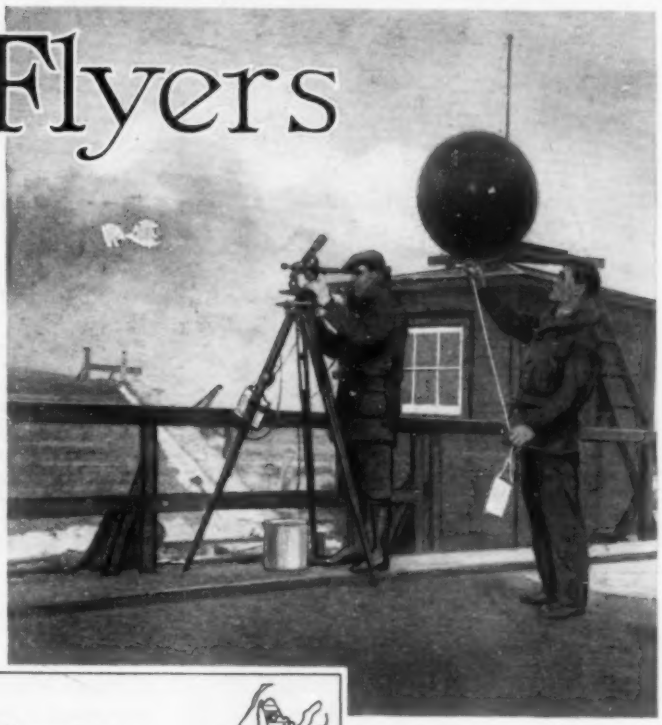
By DR. FORD A. CARPENTER

WEATHER is so important in gliding and soaring that the hundreds of glider clubs of the United States are interesting themselves in the elements of meteorology as never before. The early gliders of history, men such as Ader, Bleriot, Chanute, Langley, and the Lilienthals, Montgomery, Penaud, Pilcher, Santos-Dumont, Wentham, the Wrights and the Voisins, were all students of meteorology. The most notable pioneers of the air, the Wright brothers, had to travel from Ohio to North Carolina to find the right kinds of wind for their historic experiments. Preceding the Wrights by several years, Octave Chanute did his gliding over the sand dunes on the shores of Lake Michigan. Later, on April 29, 1905, Prof. John J. Montgomery, a Californian, made a glider that performed a feat which, if duplicated in this day of air events, would be heralded far and wide. This was when he took his glider and pilot, Daniel Maloney, aloft in a balloon to an altitude of 4,000 feet. He then released them and they glided safely to the ground. After flying for twenty minutes, Maloney brought the glider down, landing without a jar.

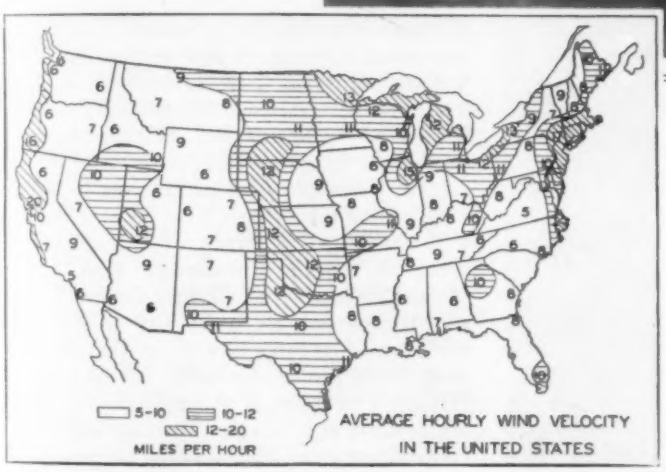
One of the best ways to locate good gliding regions is to observe the number of windmills. Windmills must be located in regions which have an average wind velocity of more than twelve miles an hour. If the wind falls below that average, the mill is inefficient as a means of power. Gliders should have winds of equal or greater velocity than windmills. Gusty winds are unreliable and treacherous, and their vicinity should be avoided. Gliding pilots recollect that near the ground the winds are choppy, like the surf pounding on the seashore. These short air waves, too, should be avoided. It is in a steady, even flow of air that the glider navigates best. In default of strong and constant winds, short wavelengths of air may be taken advantage of if their action is studied. For the experienced glider, the region of sand dunes may be utilized. Here the wind records its velocity and direction. A searcher for good gliding territory should carefully study wind tracks, whether visible on the sands or upon trees or shrubs.

Soaring flight has ever been the despair of man. He has even envied the turkey buzzard, "noblest of aeronauts." The buzzard is a most fascinating flyer. Watch where it flies, and you will find good

Tell Flyers



soaring air. Frequently it is on the windward side of some sunshiny hill. It will flap lazily toward nature's elevator and, once within the magic circle, make the wind carry it upward. Seagulls have been observed doing the same thing, only they use the upward draft from manufacturing districts. The rising currents of air, made by warming the lower levels, carry them to an altitude of as much as three or four thousand feet. As soon as the gulls achieve the desired altitude, they wheel and execute a twenty-mile glide to the ocean. Upon reaching the sea cliffs, they utilize the cliff winds.



Taking Observations at U. S. Weather Bureau Airport Station in Chicago and Special Wind Map Showing Best Localities for Gliding

Imitating the seagulls, W. H. Bowlus in his sailplane utilized the upward currents of air. He also used the strong ascending air currents that occur previous to rain. In his recent record flight of nine hours, he was particularly fortunate in utilizing the lift produced by the wind blowing against the 400-foot peninsula of Point Loma, Calif. He followed the flight of the gulls and rode upon the backlash of the wind. As a careful observer of weather, he was able to keep his plane aloft in winds of low velocity. This was accomplished by using both horizontal air movement and the "splash," as well as the vertical currents occasioned by cumulus clouds.

It should never be forgotten that cumulus clouds are the tops of rising currents of air. The actual vertical currents are below the cloud caps and, of course, are invisible. The only reason the tops of the air columns can be seen is that moist and warm air of the lower levels is sent upward into the colder strata. Here the air is condensed into visible vapor forming cumulus clouds, which are seen most

Drifting Cumulus Clouds, the Tops of Air Columns, and Seagulls in Soaring Flight, Utilizing Upward Swirls of Air

frequently in summer and spring. They rarely occur in winter, for the air is then too cool to rise. Only in storm conditions do cumulus clouds have a horizontal movement equal to or exceeding their vertical activity. Theoretically, if a glider could be catapulted from an airship into a sky filled with cumulus clouds, the pilot could navigate as long as the clouds lasted, if his physical endurance held out.

A glider pilot must be a keen observer and should know much of the science of weather. Both knowledge and action should be intuitive. Gliding depends upon two things only: gravity and wind. The glider pilot has to move his craft obliquely downward under the influence of gravity. His only support is the resistance of the air against the wings. This, of course, is augmented once headway has been established, the same as with a motored plane. There is then nearly seventy-five per cent suction on the top of the wing and about twenty-five per cent upward pressure on the bottom of the wing.

The revival of gliding in the United States is one of the most striking aeronautical events of the past year. This breaking out afresh of the interest in gliding, after a quiescent period of more than a score of years, means a corresponding awakening in weather study. As in the olden days of marine shipping, one of

Cloud Banner at the Top of Mount Hood, 11,225 Feet above Sea Level; It Tells the Airman Which Way the Wind Is Blowing

the requisites for a steamship master's license was experience in handling sailing ships, so aviators will shortly be required to have gliding experience before being given the controls of an airplane.

A glider pilot and an airplane pilot may be compared with a pilot of a sailboat and of a motorboat. The sailboat skipper has to know his weather, for it is his only motive power. The motorboat pilot's dependence is upon his engine; weather is relatively unimportant. The glider pilot is like a sailing master, he must have a good weather eye.

ACCURACY OF CRYSTAL CLOCK SECOND IN CENTURY

Controlled by electrical vibrations obtained from a quartz-crystal oscillator, similar to the "singing crystal" that keeps radio stations on their wavebands, a clock has been developed that does not vary a second in a century. Two clocks keeping different rates of time can be operated from the same crystal so as not to change in their ratio over a long period of years. The pull of gravity and the magnetic field of the earth will not affect the clock, and even earth vibrations cause little trouble. In fact it can be operated near electrical machinery or large moving masses, and the dial and even the rate of timekeeping can be altered without affecting the basic accuracy of the apparatus. It has been suggested that the clock will make possible more accurate radio signals.

AIR CLEANER AND VALVE OILER COMBINED FOR AUTO

Oil, which is quick to catch and retain dust, is used to wash the dirt out of the air drawn into the automobile motor through a filter consisting of a metal cylinder containing an oil mixture through which the air passes. The cleaner does not choke or cause the car to use more fuel, and, in tests on a wheat truck, removed a quart of dust in one day. The filter also serves as a valve oiler.

SUGAR-CANE HARVESTER CUTS FORTY TONS AN HOUR

Two Views of Sugar-Cane Harvester That Cuts the Stalks, Strips Them of Leaves and Then Piles Them

What McCormick's harvester was to the farmer, a mechanical cane cutter is expected to be to the sugar producer. It has cut as much as forty tons an hour in test runs and easily averages twenty tons an hour, doing the work that formerly required 150 field hands. Only one man is required to operate it, and searchlights enable working at night. The big machine is driven on endless-tread tractors, operated by an eighty-five-horsepower motor, which also runs the rotating blades that cut the stalks close to the ground. One of the difficulties encountered in developing the outfit was that much of the cane is blown down before harvest time, and the stalks often lie nearly flat. This problem was solved by devising a bisected snout, with a prong extending forward at the front end of the cutter, to lift the fallen stalks into a vertical position so that they could easily be severed. Rotary brushes remove the leaves from the stalks and powerful air blowers discharge them to one side as the machine proceeds. The stalks are collected in a hopper and fall in bundles onto the field, ready for collection. Successful development of the harvester permits doing all the major operations of sugar-cane raising by machines. Not long ago, a planter was constructed which has been operated with marked success.

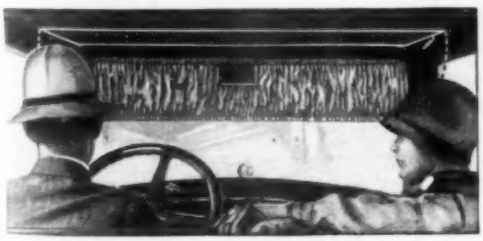
MILLION HORSEPOWER CARRIED BY LAND AND SEA CABLE

Towers rising above the sea would support cables carrying 1,000,000 horsepower at 380,000 volts in a proposed plan to transmit electric power from Norway to Germany by way of Sweden and Denmark over a power line 625 miles long. Norway, with its many high waterfalls, has a production capacity estimated at 16,500,000 horsepower, so the question of generation is only one of capital, as the engineering problems have been worked

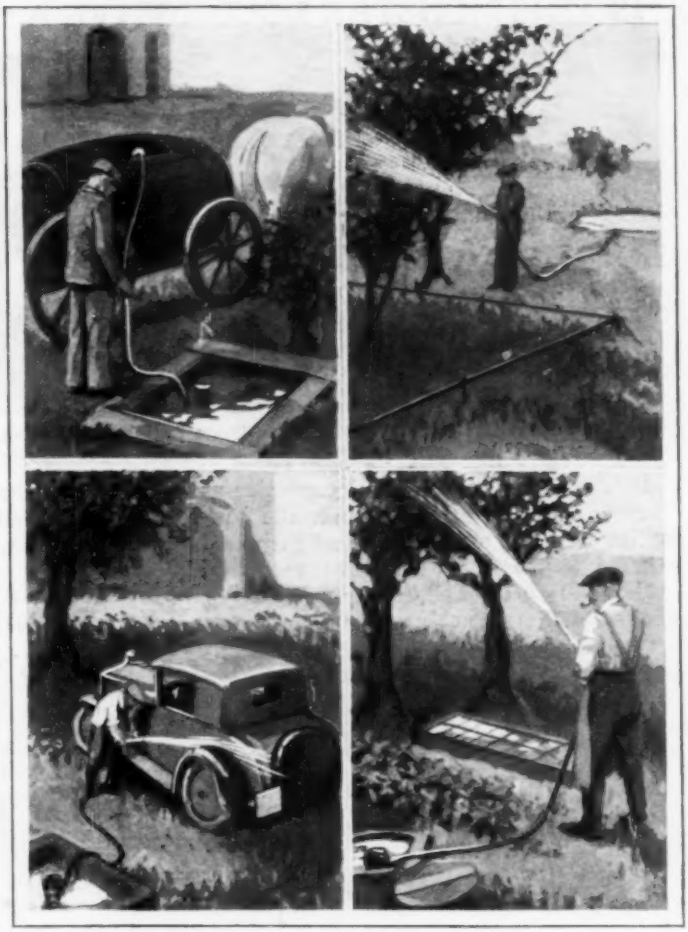
out. Technical difficulties lie mainly in transmission across the arms of the sea between Norway and the German terminal at Lubeck or Hamburg, but none of these waters are wide or deep, and it is proposed to sink concrete foundations to support cable towers extending above the water. These towers, including the bases, will have to be about 600 feet high in order not to obstruct navigation. The cost is estimated at about $200,000,000. Transmission of hydroelectric power from Sweden to Denmark across a narrow channel by submarine cable has been an accomplished fact for several years, but both the voltage and the power involved are much less.

ROLLER SHADE ON WINDSHIELD TO STOP GLARE

To eliminate sun glare in the motorist's eyes, a green silk shade for the inside of the windshield now is available. The installation of the device is easy and it may be adjusted on a roller to the proper position for vision without glare. It also is useful for night driving to cut off glare from approaching cars' lights and to eliminate the reflection in the windshield from the lamps of following cars.



Cloth Shade for Inside of Windshield Which Stops Glare of the Sun in Motorist's Eyes



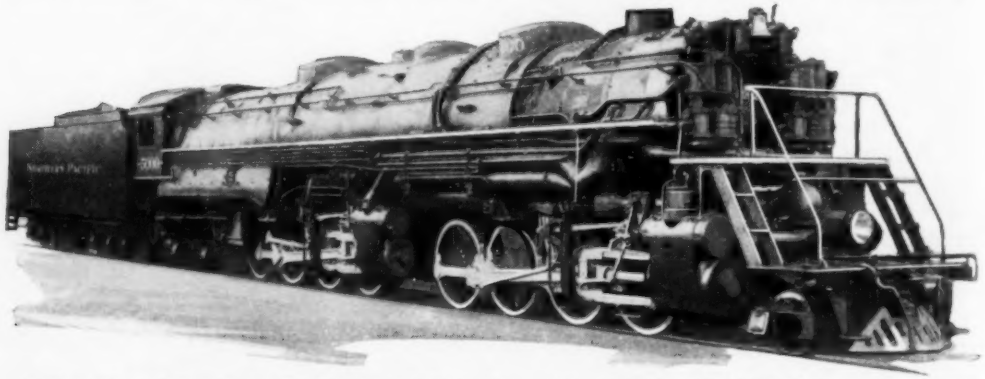
Showing Various Uses for a Floating Pump Driven by Electric Power; It Is Portable and Rests in a Watertight Casing

PORTABLE PUMP THAT FLOATS RUN BY ELECTRICITY

For places where a pressure water supply is unavailable, but where there is electric power, a portable floating pump, operated electrically, is being used successfully in Germany. The pump is self-contained and requires no mounting. It floats by reason of a watertight casing filled with air and is less than two feet high. It is operated by placing it in the well, stream or other source of water supply and connecting to the power source, and delivers seventy-three gallons of water per minute to a height of about thirty feet.

¶The electric motor was invented by Thomas Davenport in 1837.

IS THIS MONSTER LOCOMOTIVE A "HE" OR A "SHE"?

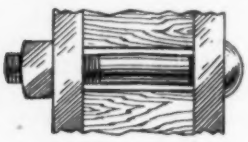


A Close View of One of the World's Largest Steam Locomotives; It Can Haul 4,000 Tons up a One-Per-Cent Grade, Burning Twenty-Two Tons of Coal an Hour

It is correct to refer to a locomotive as "he" in certain cases although the prevailing practice among railroad men and others is to use "she." This is the verdict of authorities on English, following a survey of the Northern Pacific railway. A writer, describing one of that railroad's mammoth Yellowstone-type locomotives, 125 feet long and weighing more than 1,000,000 pounds wrote, "for with tremendous power, he can easily pull 100 loaded cars uphill." The word "he" awoke a storm of protest among engineers and others who affectionately refer to their charges as "she." Most of the professors agreed that the matter is one of rhetoric and not of grammar. Several maintained that "she" is the proper word to use in describing engines generally, but admitted that in the particular case under discussion, that of one of the largest locomotives in the world, the use of "he" was entirely consistent.

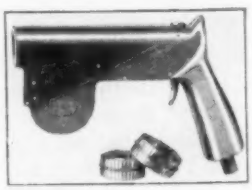
BOLT WITH SPRING EFFECT SAVES LOCK WASHER

A locking bolt that gives slightly when the nut is screwed on tight, but straightens out again when removed, now is available for purposes where a tight-fitting unit is desired. The spring effect also relieves the strain on the threads when an unusual stress occurs. The bolts have been tested by use on railroad tracks with good results. No instance of their having become loose has been reported.



GUN THAT DRIVES STAPLES ELIMINATES HAMMER

As a substitute for a hammer in driving tacks and small staples, an air gun, shaped like an automatic pistol, has been introduced. It drives from 5,000 to 10,000 tacks or staples without reloading, simply by pressing the trigger, and it is said not to jam. The "ammunition" is contained in a winding coil in the gun's magazine, while staples may be formed, cut and driven from a prepared strip of metal contained in the gun. The unit is especially serviceable in laying linoleum, carpets or roofing, and was originally intended more particularly for upholsterers.

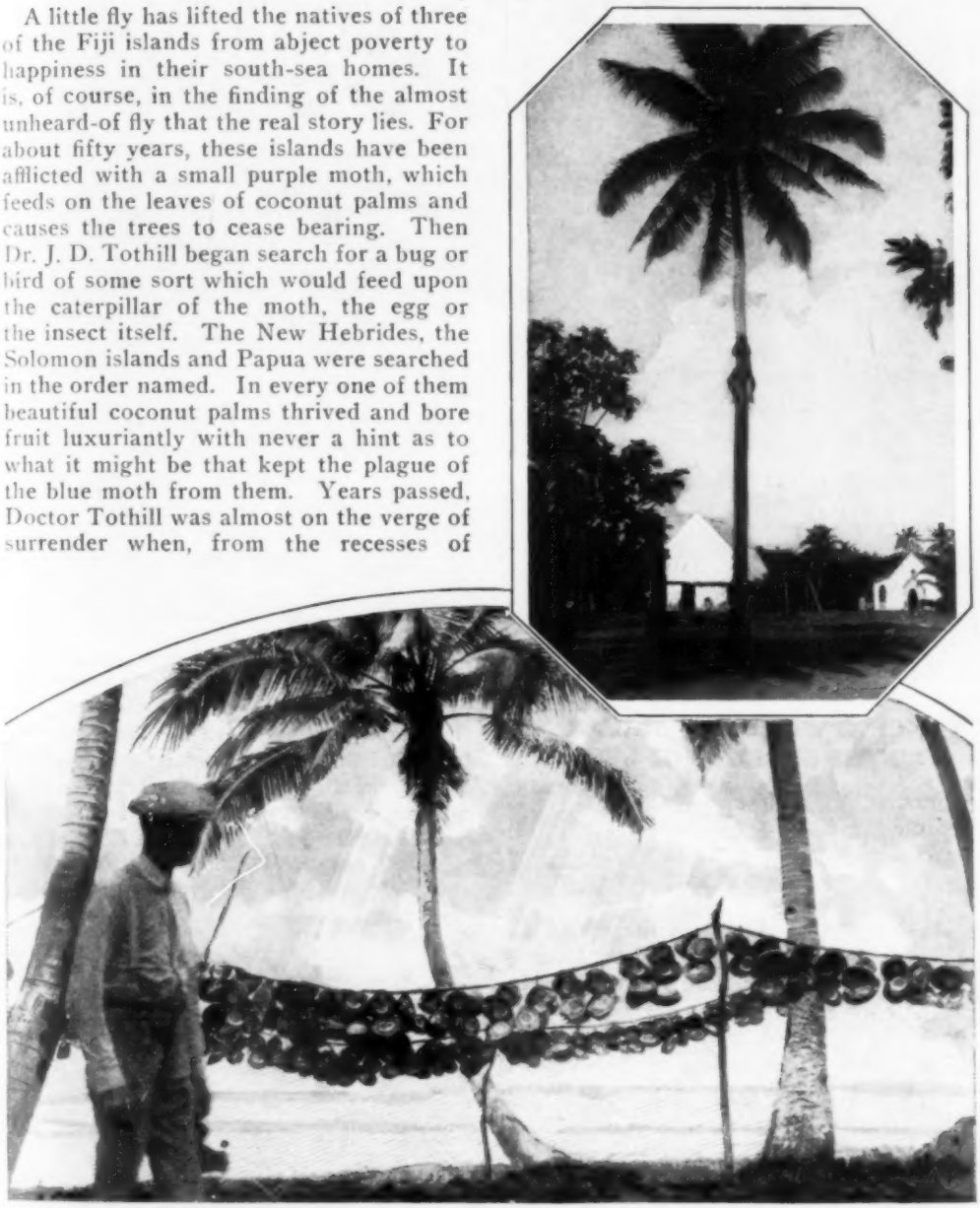


NEW ELEMENT IS RADIOACTIVE

Protactinium, a new chemical element of strongly radioactive properties, has recently been isolated by a German scientist. It is a metal of the radium-uranium group, and its atom disintegrates in the same manner as the radium atom. It is the rarest mineral so far known to science, rarer even than Illinium, discovered in 1926 by University of Illinois scientists and named for the state of Illinois.

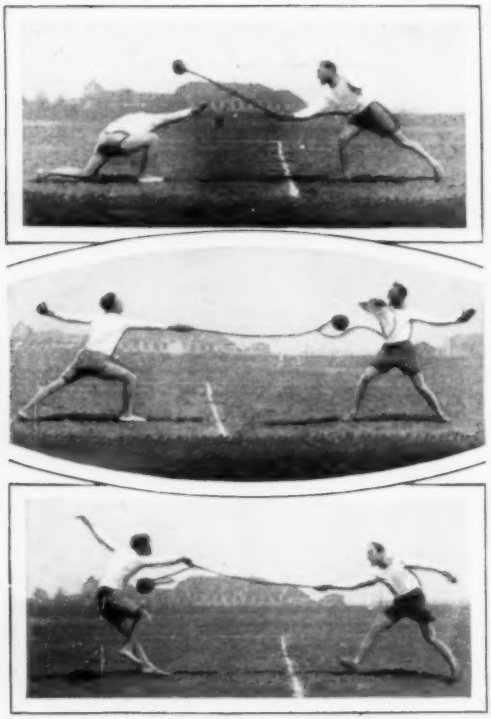
RARE FLY SAVES NATIVES IN SOUTH SEA ISLANDS

A little fly has lifted the natives of three of the Fiji islands from abject poverty to happiness in their south-sea homes. It is, of course, in the finding of the almost unheard-of fly that the real story lies. For about fifty years, these islands have been afflicted with a small purple moth, which feeds on the leaves of coconut palms and causes the trees to cease bearing. Then Dr. J. D. Tothill began search for a bug or bird of some sort which would feed upon the caterpillar of the moth, the egg or the insect itself. The New Hebrides, the Solomon islands and Papua were searched in the order named. In every one of them beautiful coconut palms thrived and bore fruit luxuriantly with never a hint as to what it might be that kept the plague of the blue moth from them. Years passed, Doctor Tothill was almost on the verge of surrender when, from the recesses of



Above, Native Climbing a Coconut Tree in the Fiji Islands; Below, Drying the Copra; the Nuts Are Split in Half for the Process, and the Dried Meat Becomes Copra

memory, came the recollection of a peculiar fly, a native of Java, which was known to feed on some kind of insect eggs. To Java he and his associates went and there found the long-sought fly, known as the Ptychomiya. These flies were imported. With surprising rapidity they became acclimated and went about their business. Today, trees which have been barren for fifty years are bearing full crops.



Fencing with Swing Ball Attached to Two Cords; the Object Is to Avoid Being Struck

FENCING WITH TOY BALLOONS OFFERS STRENUOUS SPORT

Fencing with inflated swing balls has become popular in Germany as a novel method of gymnastic exercise. The two players stand opposite each other in the pose of fencers in a court divided by a center line. The balloon is suspended directly over the line, each player holding one end of a cord which is attached to the ball by a short link. The object of the game is to so manipulate the cord as to strike the opponent with the ball, each player dodging and trying to avoid being hit.

PASTE FOR MENDING CLOTHES USED INSTEAD OF NEEDLE

Mending clothes is accomplished in the same manner as patching an automobile tire with a mending paste which withstands washing, boiling and ironing. To mend a rent, the garment is turned inside out and a patch slightly larger than the tear is fixed in place with the paste which is spread about the hole and the edges of the patch. Drying requires but one minute when the garment is ready to be worn. Since the paste also waterproofs, it may be used for umbrellas, raincoats, auto tops and leather and rubber shoes.

LETTER IS ITS OWN ENVELOPE

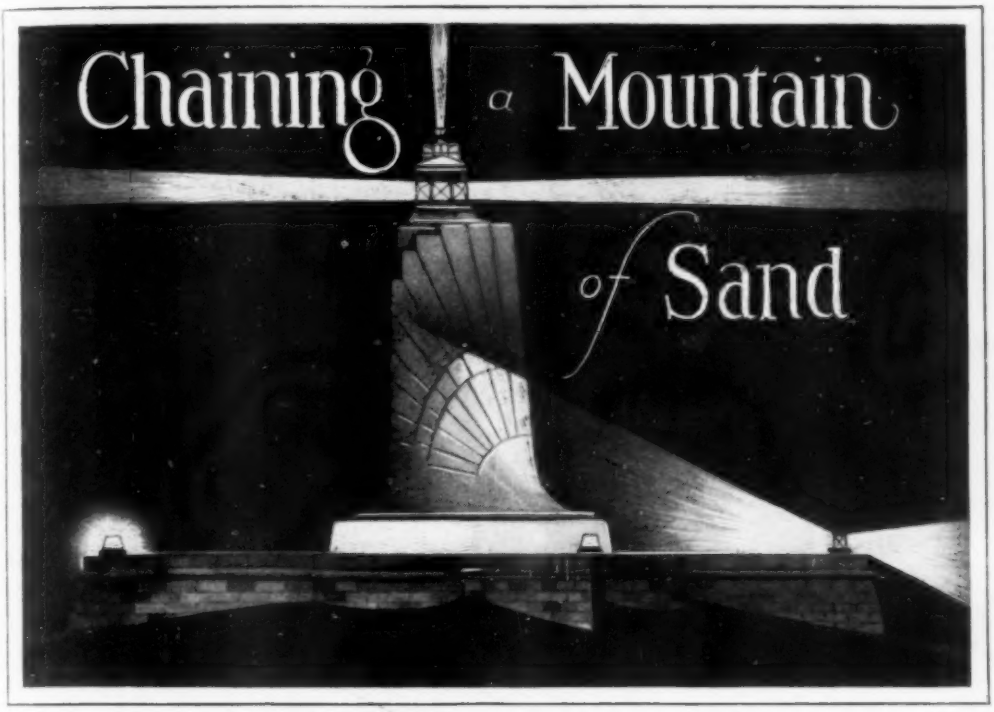
Letters that fold to make their own envelope have been produced by an Atlanta inventor and tested by the post office department. The invention itself consists of a device to be attached to an electrically operated folder. As the letters run through the machine, they come out folded and sealed so that no container is necessary, but the sealing is in such a manner that the letters are not defaced by opening. For large mailers, the machine has possibilities of effecting considerable savings.

HOT-DOG CART LIKE AN ENGINE ATTRACTS CUSTOMERS

In Vienna, home of the wiener, a woman hot-dog vendor has succeeded in attracting customers by outfitting her cart like a locomotive. The kettle in which the "dogs" are cooked is disguised as the boiler of the engine, and when vapor issues from the locomotive stack, the wieners are ready to serve.

Hot-Dog Cart, Built to Resemble a Locomotive, Gets Customers for This Vienna Woman

Chaining a Mountain of Sand



Prize-Winning Design for Memorial to the Wright Brothers to Be Erected on Kill Devil Hill at Kittyhawk, N. C.; Construction Could Not Be Planned Until the Hill's Movement Was Stopped

By HAMILTON M. WRIGHT

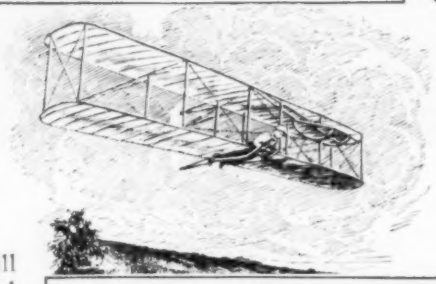
THAT vast moving mountain of sand, Kill Devil Hill, at Kittyhawk, N. C., which in the past twenty-five years has advanced 500 feet, has been chained and stabilized to form a permanent base for the monument to the Wright brothers which congress has decreed shall surmount its summit.

Kill Devil Hill is the loftiest object on the barrier beach at Kittyhawk. It rises ninety-seven feet and its prodigious base covers an area of twenty-six acres. For the past six months, under heavy northeast winds, the vast wandering cone of sand has not moved an inch, it was said by Capt. John A. Gilman, of the U. S. army, in charge of the stupendous feat. In the previous twenty-five years, under the lash of these storms, it had moved forward in a southwesterly direction at a rate of twenty feet a year. It is now more than 500 feet from its location at the time of the Wright brothers first immortal flight. It has moved that much farther from the site of a monument located at the exact spot of the take-off in that flight.

How Captain Gilman stabilized this mountain is a marvelous story of modern engineering. When congress, in 1928, voted to build a monument on the summit of Kill Devil Hill, the unruly sand mountain was as bare as the Sahara desert. Huge as it was, it was the plaything of the storms.

It was apparent when Captain Gilman took hold of the job, if a monument were to be erected upon the sand in its existing state, the mountain would walk away with the memorial. His first move after the survey had been completed was to build a fence around the hill to keep cattle from straying in and eating the vegetation he proposed to plant. The next step was to lay a strip of wood mold, two inches in depth and 200 to 300 feet in width, around the base of the hill. This wood mold consists of pine straw, rotted leaves and rotted wood. The wind does not disturb it or work under it to get a start in moving the sand, and it will support the vegetation required to form a strong surface. The mold was sown with rye, cro-

talaria from Porto Rico, some marram seed, and hairy vetch, all imported. Then was planted a native bunch grass known as bitter tannic. The final step was to form a protection to the hill itself to keep the wind from getting under and scooping out the sand. To this end, the planting of the mold was continued up the north and east sides of the hill where it was hit by the winds. Fourteen acres of the hill have been planted and only twelve remain to be completed. The total cost of the harnessing of Kill Devil Hill to date has been but $20,000, and congress has appropriated an additional $7,500 to complete the work.



Above, Kill Devil Hill Retreated from This Monument Marking Start of Wright Brothers' Flight; Center, Drawing of Flight, and, Below, Aerial View of Hill Showing Planting Which Stopped Its Movement

The design for the Wright memorial itself has already been selected in a nation-wide competition. The architects, Robt. T. Rodgers and Alfred E. Poor, of New York, will receive an award of $5,000 for the design. The monument will cost $238,000. The material specified in competition plans was cement, but it is proposed to have this changed to North Carolina granite. The monument will be fifty-five to eighty-five feet high. A government reservation of 500 acres will be used as an airport.

The great shaft will give the impression of giant wings, uplifted as if for a take-off from the crest of the hill. This effect is to be heightened at night by floodlights projected from the five points of a star-shaped base upon the four sides of the monument. A beacon tower will project a beam of light for the guidance of aviators and ships at sea.

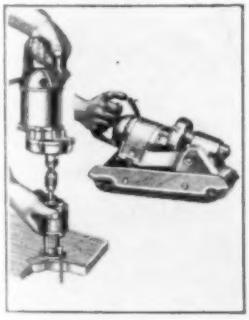
Old Kill Devil Hill thus will become the seat of a great national memorial. Flyers who take off at the airport to be constructed will have the satisfaction of knowing that here practical aviation had its birth.

FOREST FIRE-FIGHTING BRIGADE HELPS SAVE TIMBER

Fire sirens sound in the San Bernardino national forest of California when blazes break out, and a completely equipped truck company speeds to the scene, in answer to alarms telephoned to the station house. Besides reels of hose, the trucks are provided with reserve supplies of chemicals for extinguishing small fires and for use where water is not available. Installation of telephones between resorts in the forest preserve and the construction of good roads have made the fire trucks practical. There are three stations in this forest, and the companies are said to have already saved more than the cost of equipment

MOTOR SAW AND POLISHER SAVE WORKERS' TIME

Attachable to a small electric motor, a keyhole saw and portable sander and polisher have been introduced to simplify tasks where a high degree of skill is required. The saw is especially shaped to reach difficult places and is a chuck arrangement, allowing a hacksaw to vibrate up and down. It will cut board, iron or other metals, and is well adapted to work on an automobile where the floor boards or other parts have to be cut to install heaters, exhaust pipes or similar units. The sander and polisher attachment operates with belts. They are quickly interchangeable according to the type of work to be done.



MACHINE THAT SELLS STAMPS ALSO WEIGHS LETTERS

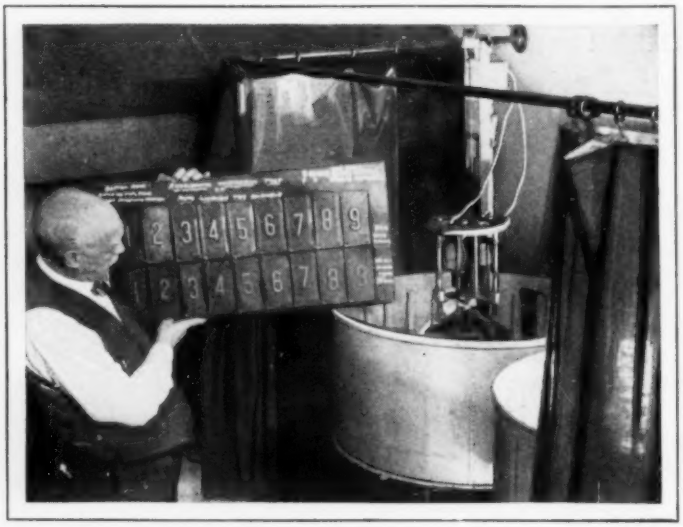
Many denominations of postage stamps, including air mail and special delivery, are obtained without extra cost from a vending machine that also includes a scale for weighing letters, a cigaret lighter and ample space for advertising material. The

The Drug-Store Post Office, a Cabinet That Includes a Stamp Vender and Scales for Weighing Letters

machine, placed in drug stores and similar places, saves the clerks the trouble of waiting on customers who wish stamps only, and the advertising space is sold at a profit. The ads are on transparent film that rotates in front of flashing lights.

LOCK ON AUTO GAS-TANK CAP ALSO PROTECTS CAR

To prevent the theft of gasoline from the automobile tank, a lock for the cap has been introduced. It can be released only by the owner's key and is so adjusted that forcible removal can be accomplished only by mutilating the tank. The cap not only protects the gasoline and reduces the fire and explosion hazard, but is also a safeguard for the auto, as anyone stealing the car would be able to drive it only as far as the gasoline supply would permit. Refilling the tank would be impossible without the key to the cap lock unless the container were mutilated, something the average automobile thief would be unlikely to do.



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Submitting Auto-License Plates to Tests in a Weather Machine to Determine Why Dull Tags Outlast the Varnished Ones

AUTO-LICENSE PLATES TESTED IN WEATHER MACHINE

In an effort to determine why some automobile-license plates fade in a short time while others last a full season, scientists of the bureau of standards submitted them to tests in a weathering machine. Some plates were given glossy coats of varnish to preserve them, while others were left dull, and all were exposed to the effects of the artificial weather maker, which in thirty-seven days subjected them to the wear and tear to be expected from months of hard use on cars. In every instance, it was found that the dull tags outlasted those that had been varnished, and stood the test better.

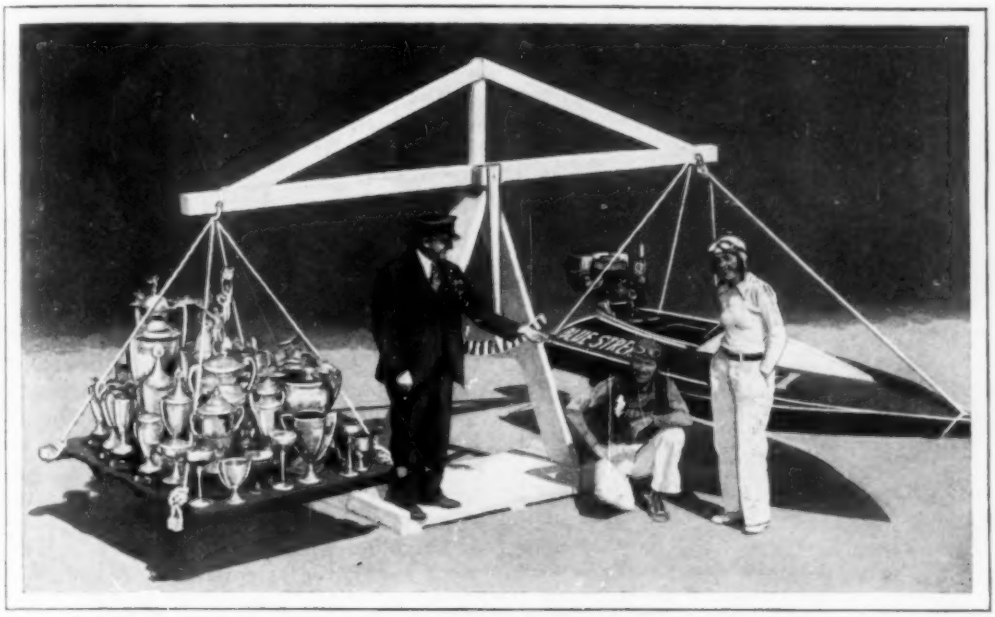
SILENT KEY IN ADDING MACHINE DEFRAUDS CUSTOMERS

By making use of a "silent key" in some types of adding machines, dishonest merchants have been detected defrauding customers. This key can be shifted so that amounts punched on the adding machine will show in the total, but will not be itemized. In rush hours a tradesman wanting to be dishonest punches a small sum on the silent key, and the customer, if he checks the slip at all, merely notes the price of items without adding them.

EXPOSURE METER ASSURES BETTER PHOTOGRAPHS

To eliminate the usual hit-and-miss method employed by amateurs in determining the period of exposure in taking still or moving pictures, a photometer has been developed which accurately measures light intensity on the subject to be photographed. Instead of gauging the light in a room, for instance, the exposure meter measures the amount falling on the object in the room that is to be photographed. The brightness of a small surface in the instrument is made to match the brightness of the object through regulation of the incandescent filament of a small electric light which is supplied with current by a battery and regulated by a dial. When the brightness of the object and filament are the same, the dial reading shows the lens diaphragm opening to be used in the camera. This method makes it possible to measure the exposure required to register shadows or high lights, or to strike an average between the two by taking separate readings for the dark and light portions.

Looking into a Photometer Which Measures Light Intensity on a Subject to Be Photographed



Visual Proof That the 225-Pound Speedboat, "Blue Streak," Is Worth Its Weight in Silver and Gold; Its Racing Cups and Trophies on the Scales Balance the Weight of the Boat

SPEEDBOAT WINS ITS WEIGHT IN PRIZES AND TROPHIES

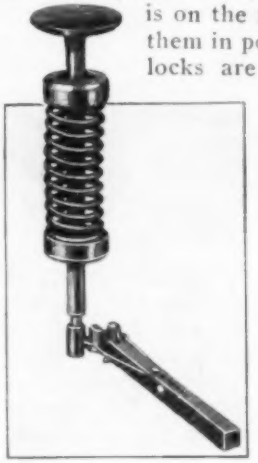
Winning its own weight in prizes and trophies is the accomplishment of the "Blue Streak," famous outboard speedboat owned by Dr. Leo Baughman of Los Angeles. The 225-pound craft has captured its weight in gold and silver cups emblematic of the many contests in which it has come in first. Visual proof of this was afforded recently when the boat was attached to one end of a balance scale and its winnings at the other.

BLUE FAVORITE COLOR OF MEN WOMEN'S IS GREEN

The majority of men prefer blue while green is the favorite color of most women with red their second choice, tests on 800 students at the University of Nebraska have disclosed. The experiments were made by Prof. William E. Walton with a special machine he invented for projecting different colors, controlling their intensity and the length of time they were visible. When the intensity of all the colors shown was the same, both men and women preferred red, the tests proved, indicating that intensity of shade had much to do with color choice and that red is an excellent color for general attractiveness when it is of the proper intensity. Red was also most easily seen. Racial differences, on the whole, seem to make little change in color preferences. Red, blue and green are consistently popular with all races.

KEY INSERTER FASTENS VALVES WITH LITTLE EFFORT

For use on the larger cars and trucks with two-piece valves, a key inserter now is on the market which locks them in position quickly. The locks are placed in the inserter compress valve spring, and entered with a push, after which the spring is released, leaving the locks in place.



¶Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

Learning to Dance by Radio: the Pupils Move on Squares According to Broadcast Directions

DANCING IS TAUGHT BY RADIO ON PORTABLE FLOOR

Dancing instructions are broadcast by radio in Germany, and the pupils are said to learn as many as five new steps in a single week by using a portable, numbered floor to follow the directions given by the instructor. The floor is ruled into red and green squares and each division is numbered. The right foot is to be kept on the red squares and the left on the green. By obeying the detailed directions as announced, according to the numbers, the dancers soon learn the movements for a special step. A Berlin dancing master developed the method of instruction and does the broadcasting

PLANTS ABLE TO PICK COLORS IN LIGHT RAYS

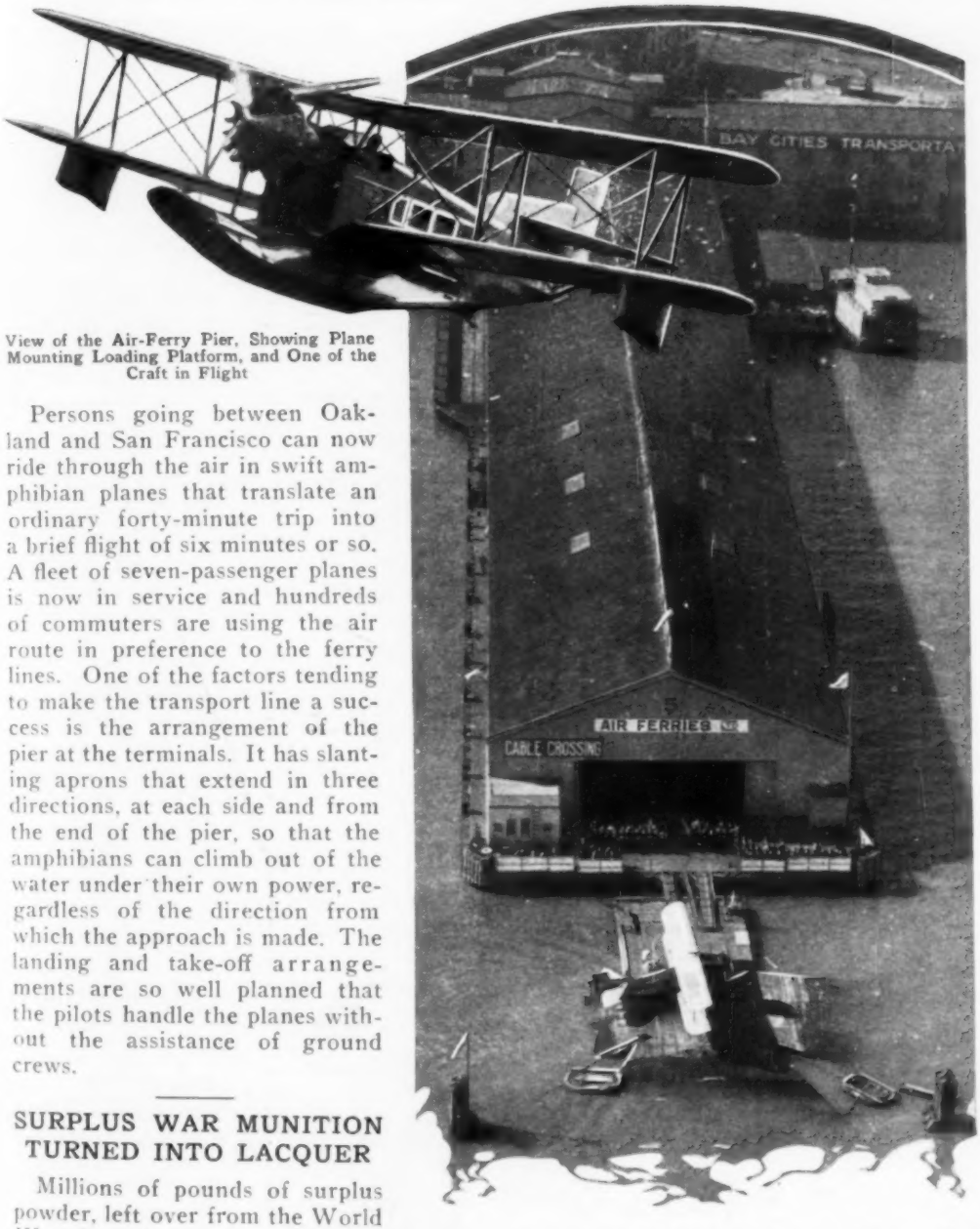
Plants can distinguish between different colors when exposed to light and indicate their choice by bending toward the radiation that they find hardest on their growth, scientists of the Smithsonian Institution have determined. An electric lamp was placed at either end of a dark chamber, the light passing through a color screen, and between the lights was placed a young plant at a point where the energy of the light beams was found to be exactly equal. Since the plant grew less on the side exposed to the more growth-retarding of the beams, it was pushed over toward this beam by the more rapidly advancing side. All kinds of visible light appeared to have a retarding effect on growth. Red light and infra-red rays were found to have little effect as also was the case with yellow. The green sector of the spectrum had a powerful influence, and the blue-violet groups were stronger still in causing growing plant tips to bend. Tests of the color likes and dislikes may eventually lead to exposing some of the secrets of the mechanics by which the chlorophyll of green leaves uses sunlight to combine carbon dioxide and water to make sugar, the scientists hope.

WHEELS FOR A CRIPPLED DOG ENABLE IT TO WALK

"Lady Lou," a Boston terrier, probably is the only dog that travels on wheels under its own power. The animal's hind legs were paralyzed when it was struck by an automobile and its Kansas City owner mounted the dog's rear quarters on rubber-tired wheels supported by straps and braces, enabling the dog to propel itself with the front feet. It makes good time on a smooth pavement.

This Dog Runs About on Wheels Since Its Hind Quarters Were Paralyzed after an Auto Accident

SPECIAL PIER FOR AIR FERRY SPEEDS BAY TRAFFIC



View of the Air-Ferry Pier, Showing Plane Mounting Loading Platform, and One of the Craft in Flight

Persons going between Oakland and San Francisco can now ride through the air in swift amphibian planes that translate an ordinary forty-minute trip into a brief flight of six minutes or so. A fleet of seven-passenger planes is now in service and hundreds of commuters are using the air route in preference to the ferry lines. One of the factors tending to make the transport line a success is the arrangement of the pier at the terminals. It has slanting aprons that extend in three directions, at each side and from the end of the pier, so that the amphibians can climb out of the water under their own power, regardless of the direction from which the approach is made. The landing and take-off arrangements are so well planned that the pilots handle the planes without the assistance of ground crews.

SURPLUS WAR MUNITION TURNED INTO LACQUER

Millions of pounds of surplus powder, left over from the World War, have been converted into automobile lacquers. The transformation has not been difficult as the chemical base of powder is like that of lacquer, cellulose being an important material in both. During the war, the central powers were compelled to use wood pulp in the manufacture of smokeless powder as the supplies of cotton had been cut off by blockades. The allies probably would have had to resort to the same expedient had the war lasted longer, as the 1918 crop of short-staple cotton would not have sufficed for the total demand.

The Entire Population of a Remote English Village Goes Sailing on a Railroad Truck, the Town's Only Means of Travel

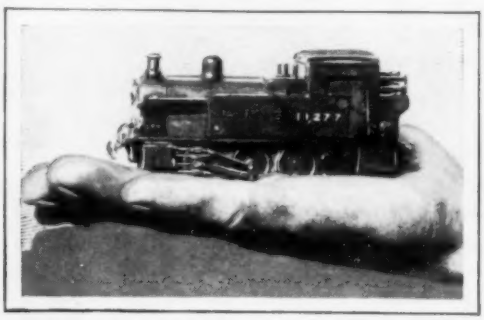
RAILROAD HANDCAR WITH SAIL HAULS ENTIRE VILLAGE

Going sailing on the railroad tracks is the principal mode of transportation for the people of Spurn Head, an English village inhabited only by the members of a lifeboat crew and their families. It is five miles by rail from this lonely settlement to the nearest town, and the men, most of them former sailors, have rigged up a sail on a railway truck resembling an ordinary handcar. The sail-driven car can, if necessary, transport the entire settlement at one time, as is the case in the illustration.

URANIUM MADE BY ELECTRICITY MEASURES INVISIBLE RAYS

Uranium, one of the elements of the earth, hitherto almost priceless because it could only be made in small quantities, now can be manufactured for about $400 a pound. The latest method of manufacture is electrical, the most expensive part of the process being the preparation of the green salts from which the metal is obtained. The first stage produces a gray powder which is poured into molds and pressed into a metallic substance resembling tungsten. At this stage, the metal is virtually explosive if left exposed to the air, but it is reduced to a true metal in a vacuum furnace in which the fusing heat is produced by electrical induction. Up to now, its uses have been confined mostly to measuring ultraviolet light and to X-ray work. It is sensitive to ultraviolet rays, but not to visible light, and is useful in photo-electric cells to measure the ultraviolet light for persons taking such treatments.

WORKING MODEL LOCOMOTIVE FITS IN PALM OF HAND



Working Model of a British Locomotive, Exact in Detail, but so Tiny It Rests in the Hand

Exact in every detail, yet so small that it rests easily in the palm of the hand, a working model of a British locomotive has been made by an English mechanic. Three months were required to complete the little engine, which is constructed to scale.

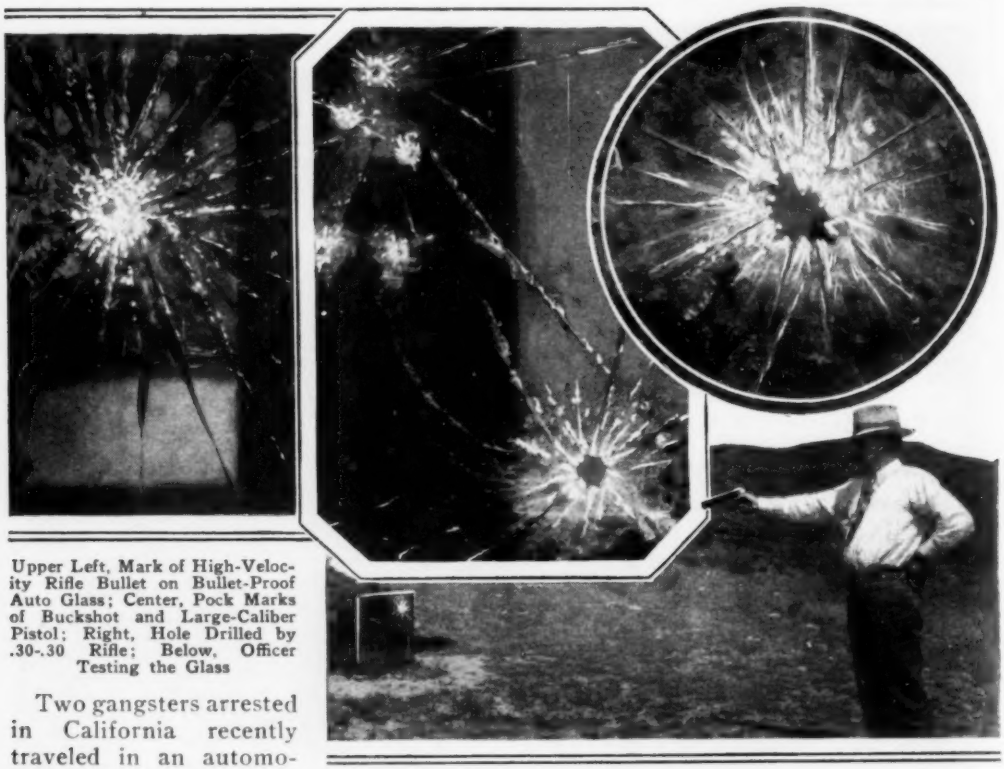
RARE ANIMALS ARE FOUND IN WILDS OF ABYSSINIA

Capt. Harold White, Leader of Recent Expedition into Abyssinia, George Carey and John Coats Sight a Pack of Lions While Resting in Camp; the Journey, Sponsored by the Field Museum of Natural History, Led into the Remote Regions and Netted Many Valuable Specimens for the Museum; Right, a Captured Baby Hyena

Above, a Young Dik-Dik, Small Variety of African Antelope, So Tiny That It Can Be Held in the Hand; at Right, an Arch Enemy of the Ant, the Aardvark, a Species of Ant Eater and One of the Most Difficult Animals to Capture; the Travelers Also Made a Study of the Peoples of Abyssinia

© Field Museum of Natural History

GANGSTER CAR FITTED WITH BULLET-PROOF GLASS



Upper Left, Mark of High-Velocity Rifle Bullet on Bullet-Proof Auto Glass; Center, Pock Marks of Buckshot and Large-Caliber Pistol; Right, Hole Drilled by .30-.30 Rifle; Below, Officer Testing the Glass

Two gangsters arrested in California recently traveled in an automobile behind a protecting shield of glass. Glass in the windshield was more than three-quarters of an inch thick and that in the windows was one and one-eighth inch in thickness. Visibility was unimpaired except when looking through the thick plates at a decided angle. The body of the automobile itself was not armored, the owners frankly explaining that bullets were aimed at the windows and not the body. The glass itself was of the non-shattering kind, built up of layers alternated with other layers of transparent material to hold the sections together, and was not in the least different from any other windshield or motor-car glass, so that it would fool even the astute gunmen of an opposing gang into thinking it nothing out of the ordinary. Before removing the bullet-proof glass from the car, the police submitted it to tests and found that it required a medium-power deer rifle, shooting a high-velocity bullet, to penetrate the windowpanes. Buckshot made a scarcely noticeable freckle on the glass, and pistol bullets likewise failed to do more than leave a mark and start star-shaped cracks until two bullets from a large-caliber pistol were placed in exactly the same place.

BEST COLORS FOR SIGNBOARDS

To investigate the visibility of various colors for use in outdoor advertising, an English company recently erected a huge signboard on which advertisements were displayed in an open field for comparison under expert supervision. In general, the tests showed, that black print on a yellow background or green on white gave best visibility. Then followed red on white, blue on white and white on blue. Black on white, the common form of printing, came next, revealing that its visibility stands far down on the list. Still less effective were yellow on black, white on red and white on black. Red print on yellow, green on red and red on green all proved to be entirely unsatisfactory.

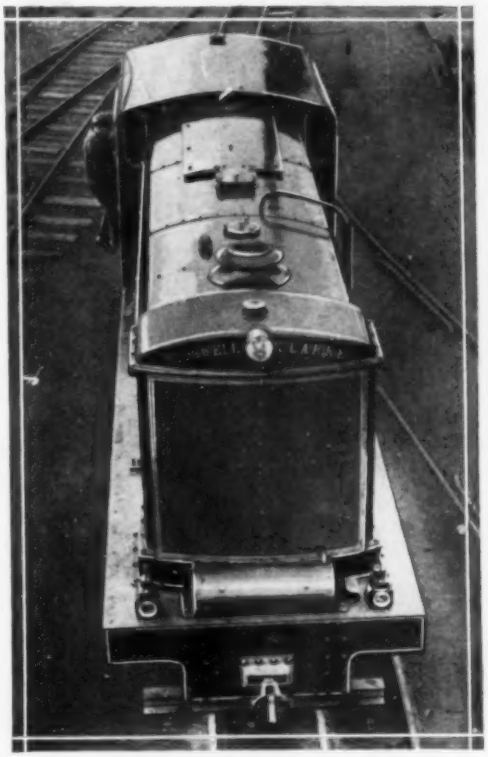
WORLD WAYS OF TELLING TIME TOTAL SIXTY-THREE

Sixty-three varieties of time are in use throughout the world, according to a tabulation prepared by the Royal Observatory at Greenwich, England. Local time is taken from the noon position of the sun, and therefore in its apparent movement from east to west, the local time shifts. This system was used everywhere until modern transportation complexities made the standard time belt necessary. Among North American countries Newfoundland and Labrador are the only ones that have not accepted this system, the time in these territories being twenty-nine minutes faster than that of the most easterly Canadian belt. In South America, Ecuador uses a standard time about fourteen minutes behind the real time belt, with the capital city of Guayaquil five minutes and seventeen seconds slower. The tabulation does not take into consideration daylight-saving time.

RADIO HEADSET FOR THE DEAF ATTACHES TO TEMPLES

Special receivers to enable deaf persons to listen to the radio now can be placed in an ordinary headset which plugs into any radio. The person who is hard of hearing places the receivers against the temples, then increases the volume until he can hear best.

Radio Headset for the Deaf, Which Is Placed against the Temples Instead of over the Ears



Looking Down on Diesel Locomotive Constructed for High-Altitude Service in Chile

DIESEL ENGINE FOR RAILROAD SERVES MOUNTAIN LINE

Designed especially for service at high altitudes in Chile, a Diesel locomotive has been constructed in England. Efficiency losses in ordinary steam engines are greater when the atmosphere is rare, and these disadvantages are expected to be eliminated in this special engine.

SPEEDERS CAUGHT BY CAMERA

To detect motorists who break speed laws when no officer is near, an English minister has invented an apparatus to take the picture of the license plates of offenders. It consists of hydraulic cylinders sunk in the pavement and electrically connected to a clock and camera. The cylinders cause the camera to operate when a car runs over them at excessive speed. The same apparatus also can be employed to flash a light or sound a siren at an intersection when a car approaches.

New Conveniences

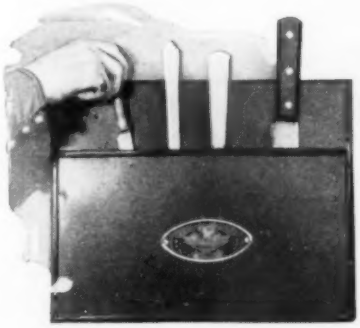
Combined Stool and Clothes Drier Saves Kitchen Space and Time; the Rods Will Hold Many Garments; Below, the Stool in Use

Basket with Special Holders Helps Keep Dishes from Breaking

Hosiery Protectors, Shown Above, Are Easily Put On and Are Furnished in Different Sizes and Colors; They Add to Life of Hose and Can Be Carried in Handbag

Iron Holder, at Left, Prevents Fires and Slides In Flush with Board When Not in Use; at Right, a Holder for the Covers of Glass Dishes to Keep Them from Breaking

for Your Home



Knife Holder Protects the Blades and Housewife's Hands as Well

Electric Sprayer, Operated by Vacuum Cleaner, Spreads Moth Preventive Liquid Said to Be Effective for Five Years Unless Articles Are Dry-Cleaned or Washed with Soap

This Costumer for Men Holds Suit, Tie, Shoes and Shirt; It Occupies Little Space and Is Easily Moved About for the Convenience of the User

Here Is a Wickless Vapor-Burning Oil Stove That Is Lighted Simply by Turning an Electric Switch; the Vapor Burns like Gas

Walking Stick Whose Different Parts Compose a Musical Instrument Resembling a Violin

VIOLIN INSIDE WALKING STICK MAKES MUSICAL CANE

Walking stick and violin are combined in a cane owned by a Glasgow, Scotland, dealer. The handle is unscrewed to reveal the hollow inside containing the bow, and a portion of the side may be removed to bare the strings and bridge.

LEARN TO FLY IN EIGHT WEEKS AVERAGE TIME

Learning to fly costs a private pilot an average of $550 and eight and one-half weeks of his time, a survey of the department of commerce reveals. Tuitions for private licenses in approved flight-instruction schools were found to range from $345 to $650, exclusive of board and room, and courses ran from five and two-thirds weeks to two and three-fifths months as average minimum and maximum. For a limited commercial course, the average cost was found to be $1,271, the average minimum time being two and four-fifths months, and the average maximum four and three-fifths of a month. The average cost for the transport pilot was $4,255, the average time ranging from seven months to a week short of a year. Variations in cost and length of courses were attributed to additional training beyond minimum requirements given by some schools, and to weather conditions. None of the schools agreed to furnish employment for their graduates.

GOOD-NATURED STINGLESS BEES PRODUCE WHITE HONEY

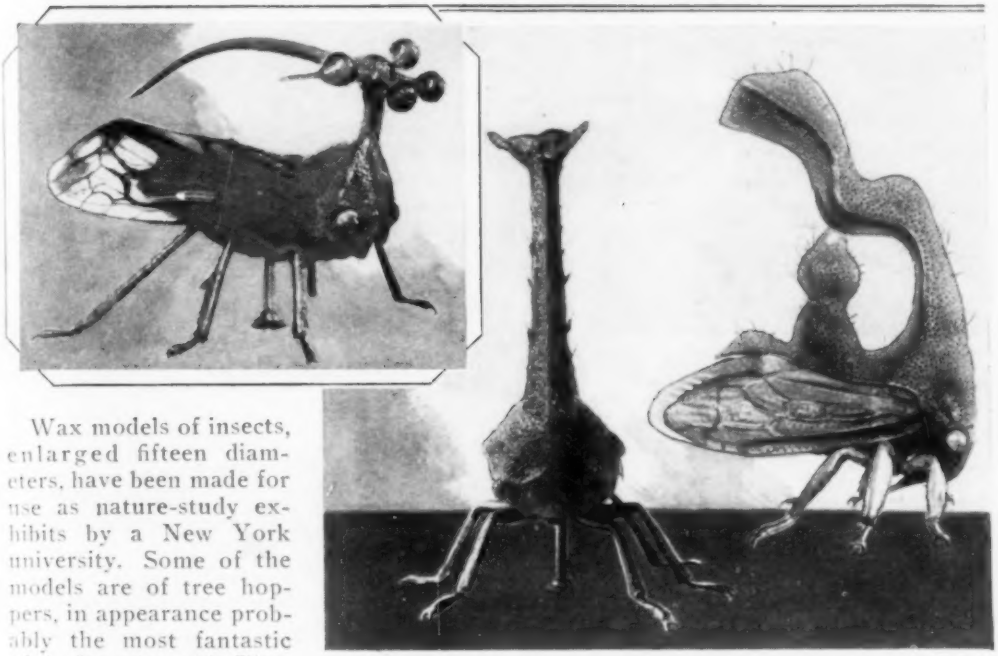
Caucasian bees, a silver-gray variety from Russia, that make an extremely white comb honey and seldom if ever sting, although they have stingers, have been raised with success at the New Jersey agricultural experiment station. They produce as much honey as the usual Italian colonies, they swarm less frequently, and, during three years' experience with them, the bee specialist at the station has never been stung. The gray color is due to a growth of small hairs that cover the bodies which are brown like those of other bees.

AUTOS ARE TURNED IN STREET BY TURNTABLE

Following the lead of London, Paris now is installing turntables in some of its narrow streets so automobiles can turn around. The car in a street too narrow to make a turn is driven onto the table and swung around much like a locomotive at a roundhouse.

Auto Turntable Used in Narrow Paris Streets

WAX MODELS OF INSECTS AID IN NATURE STUDY



These Fantastic Creatures Are Not Dangerous, but Are Wax Models of Insects, Enlarged Many Times; They Represent Tree Hoppers

Wax models of insects, enlarged fifteen diameters, have been made for use as nature-study exhibits by a New York university. Some of the models are of tree hoppers, in appearance probably the most fantastic of the insect world. They live by sucking the juice of small plants and trees, and, being clumsy in flight, acquired their name from the habit of awkwardly jumping a considerable distance. The tropical types are gorgeously colored, and none but experienced collectors can find them because their bodies take on the color of their surroundings. Their grotesque appearance is due principally to the peculiar development of the thorax, which grows back over the body and, in different varieties, terminates in spines, horns or balls.

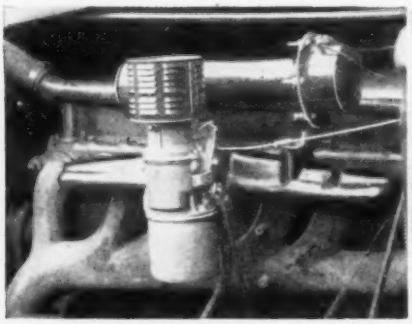
READY-MADE LAWN IN ROLLS LAID LIKE A CARPET

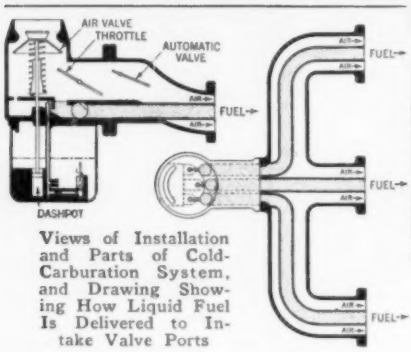
Grass turf for lawns now is obtainable ready-grown, being purchased in rolls and laid in the yard like a carpet by unrolling the various sections. The strips are composed of creeping bent-grass turf grown in nurseries. The sod is then taken up in sections and rolled like a rug. This method of obtaining a full-grown lawn overnight has been used by golf clubs and landscape gardeners, but has not been available to the individual home owner. The grass gives a heavy, solid growth and makes a lawn virtually free of weeds because the strips are weed-free when placed, and the grass is far enough advanced to repel weed invasion.

SCREWS KEPT TIGHT IN WOOD BY THREADED HOLDER

In wood where ordinary screws and nails pull out, a threaded screw holder may be used to act as a nut for the screw. It is an oblong plate of brass with a threaded hole near its pointed end. Grooves along the plate allow protruding ends to be broken off when it has been driven into position at right angles to the direction in which the screw is to be inserted. It will hold in wood joints and at corner places for fastening hinges or strike plates.

COLD GAS PROMISES TO INCREASE POWER OF AUTO





Views of Installation and Parts of Cold-Carburation System, and Drawing Showing How Liquid Fuel Is Delivered to Intake Valve Ports

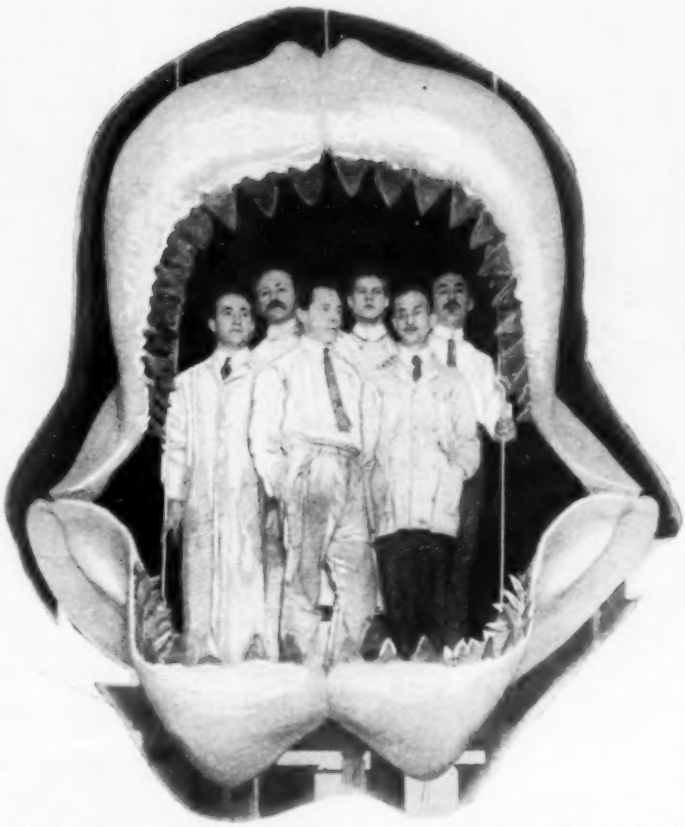
A seven to thirteen-per-cent increase in power, easier starting and quicker "warm-up" are the interesting features claimed for a new carbureting system developed for General Motors. Whereas conventional carburetor and intake-manifold installations attempt to supply a mixture of (more or less) vaporized fuel and air, the "cold-carburation system" throws this principle overboard and delivers fuel which is mostly liquid direct to the intake valve ports, where it is picked up by pure air and carried into the cylinders. Looking at the diagram, it will be seen that the "outside" manifold carries pure air only, while the "inside" manifold carries liquid fuel and sufficient air to sweep the liquid particles along. These two streams meet at the intake valve ports and mix on their way into the cylinders. Within the carburetor there are three jets, one for each of the three tubes which compose the inside manifold. There are four throttles, all hooked together, and in addition there is a throttle controlling the air in the outside manifold. With present practice, the carburetor only partially vaporizes the fuel, most of it entering the manifold as fine particles of liquid, and the air has to whisk these particles along like rain in a gale of wind. The mixture speed through the manifold at full power is usually about two and a half miles per minute. Obviously the heavy particles are thrown out by centrifugal force whenever the mixture rounds a turn. Some of these particles also collect on the walls of the manifold and flow into the cylinders in slugs. All of which means that the cylinders do not get exactly the same amount of fuel. In extreme cases, loss of power may result, but more usually the penalty is reduced fuel economy, since the carburetor must be adjusted to give an adequately rich mixture to the leanest cylinder, and thus the others receive too much fuel. A still more serious defect is the necessity for applying heat to the conventional manifold. Heat improves the distribution not only by vaporizing some additional liquid but also by breaking up the remaining liquid particles into smaller sizes which are more readily carried along by the air stream. But heat is objectionable because it reduces power, since the power which an engine develops depends on the weight of air drawn into the cylinders.

and the lower the temperature of the air the less it is expanded and therefore the more it weighs. The greater power claimed for the cold-carburation system is due mainly to the elimination of heat on the manifold, although the ability to use a larger manifold and a somewhat higher compression also assist the power. Finally, almost as soon as the engine is started, the choke may be released, and yet the engine has the feel of a warm engine—the usual period of sputtering and loss of power is eliminated.

MAGIC TABLE LEGS ADJUST SELVES TO FLOOR

Self-adjusting table legs that automatically shrink or extend to correct any unevenness of the floor on which they rest, are the product of an English inventor. The legs contain sealed chambers of glycerine for their bearings and this is the secret of the growing or shrinking. If a leg is pulled off the carpet, it automatically lengthens itself to reach the floor.

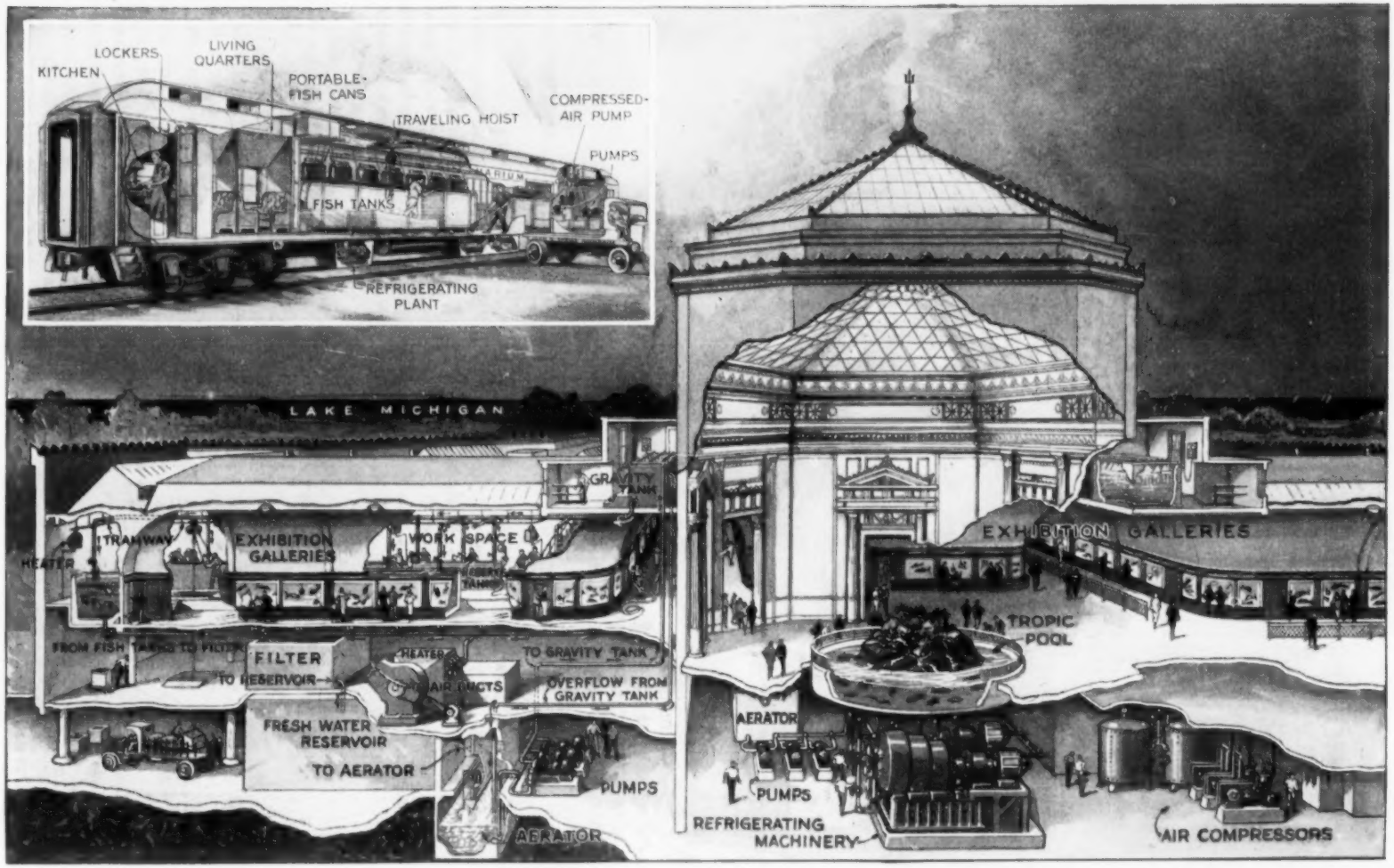
Table Legs with Glycerine Chambers as Bearings Adjust Themselves to Uneven Floor



Huge Jaws of Prehistoric Shark, Reconstructed from Its Fossilized Teeth Which Furnished a Gauge to Its Mammoth Proportions

SHARK'S JAWS RECONSTRUCTED FROM FOSSILIZED TEETH

From its fossilized teeth alone, scientists of the Marine Museum in New York have reconstructed the mighty jaws of a mammoth prehistoric shark, probably the most formidable creature that ever roamed the ancient seas. The battery of daggerlike teeth, many over six inches long, were found in phosphate beds on the Atlantic shores of South Carolina. These furnished the scientists a gauge in determining the size of the jaws which gape open over seven feet and hold the standing figures of half a dozen men. It is estimated the shark which owned the teeth was more than eighty feet long and weighed over fifty tons. The whale shark of today seldom measures more than forty feet. A ton of large and small marine creatures probably provided one meal for the big shark.



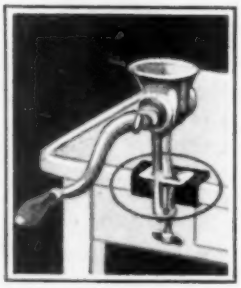
Artist's Drawing of the Shedd Aquarium and the Special Pullman Car Built to Transport Fish; It Is an Aquarium on Wheels; the Large Sketch Shows How Boxes Are Unloaded from the Motor Trucks on Electric Hoist and Placed Directly in Tanks; General Plan of Water Circulation Is Also Illustrated

FISH FIND COMFORTS OF HOME IN NEW AQUARIUM

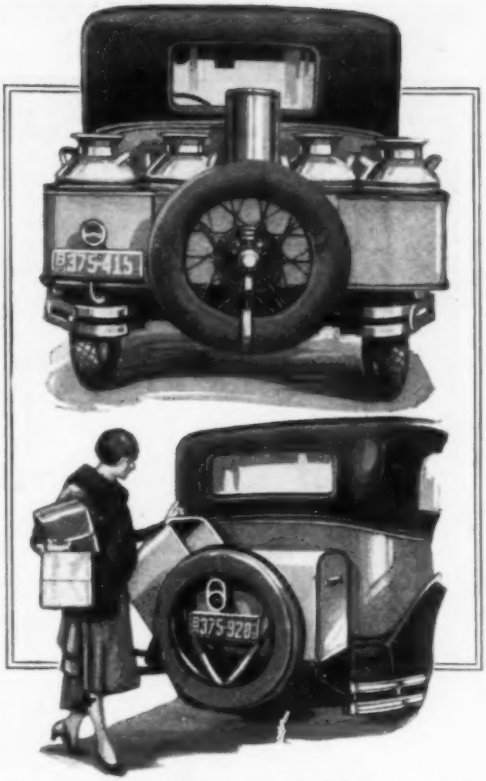
Fish from every part of the world swim in the recently completed $3,000,000 John G. Shedd aquarium in Chicago. The marble structure, suggestive of a Greek temple, with its 132 exhibit tanks, its five separate water systems, laboratories, hatchery, hospital for taking care of sick fish, "violet ray" glass, natural salt water hauled from the Gulf of Mexico in tank cars, and many other interesting and unusual features, is considered a triumph in scientific construction, beauty and efficiency. To facilitate the collection of specimens, a special railroad car was constructed and fitted up as a complete aquarium on wheels. Behind the scenes in the aquarium is a huge refrigerating plant which can freeze 450 tons of ice every twenty-four hours. It provides cold water for the fish that need it. In most aquariums, a trickle of bubbles is seen arising from a compressed-air inlet to supply the water with oxygen. This method of aerating the water is not necessary in the Shedd aquarium, the water being aerated as it flows into the tanks by means of a special nozzle, so constructed that air is drawn into the stream as it passes out of the pipes. Tanks supplying warm water are fitted with heating coils and a floating thermostat control so that the temperature automatically is kept at the right point. Expeditions are planned to secure specimens hitherto unknown to public aquariums and fishes that cannot be displayed alive will be exhibited in a preserved state.

Artist's Drawing of the Shedd Aquarium and the Special Pullman Car Built to Transport Fish; It Is an Aquarium on Wheels; the Large Sketch Shows How Boats Are Unloaded from the Motor Trucks on Electric Hoist and Placed Directly in Tanks; General Plan of Water Circulation Is Also Illustrated

PAD FOR FOOD GRINDER SAVES TABLE FROM DAMAGE



For use with the food grinder, ricer, shredder, fruit-juice extractor or other kitchen utensil with metal clamps, a pad now is available which protects the table from scratches and scars made by the clamps. The pad also prevents slipping and sliding of the device when clamped to the table.



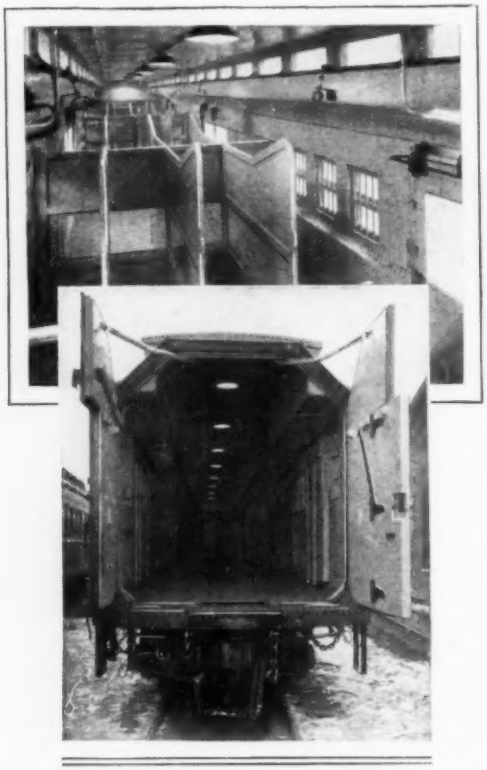
Extension Luggage Carrier with Telescoping Ends, Which Hauls Almost as Much as a Small Truck

EXTENSION LUGGAGE CARRIER HAS LARGE CAPACITY

With a capacity limited only by the weight the springs of the auto can bear, an extension luggage carrier with telescoping ends has been placed on the market. Normally it is a neat-looking trunk that is opened by swinging the two end sections outward. When the ends are locked in open position, however, it has a carrying space of fifteen by seventeen by seventy inches, which makes it suitable for the camping trip or any other occasion when bulky luggage is to be carried. It is all-metal with black lacquer finish but can be furnished also in other colors.

¶The Popular Mechanics' Bureau of Information offers its free service to all readers of our magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession, will be promptly furnished upon application to the bureau.

DE-LUXE BAGGAGE CAR CARRIES AUTOS, HORSES OR SCENERY



Interior Views of the Combination Car; Upper Shows the Stall Partitions; Lower, Car Open for Autos

Five special baggage cars, built to accommodate race horses, automobiles or scenery, have been placed in service on the Chicago and Northwestern railroad. Lights are recessed in the walls, windows slide up and down instead of swinging in and out, and the entire plan permits a quick change of the interior to suit the shipment. Special attention was paid to the matter of comfort when horses are carried. The interior is smooth, eliminating hazardous obstructions, twenty-eight windows, four feet from the floor of the car, are intended to prevent the horses from getting rheumatism, and there are forty-four ventilators. The entire end of the car swings open to facilitate loading and unloading. There are provisions for twenty-four or eighteen stalls, and when the car is used for shipments other than animals, the partitions are stored in one end. Electric lights, steam heat and wood-block floors to protect horses' feet, are other features. Each car is over seventy feet long inside and approximately eight and one-half feet wide.

TOAD VENOM MAY YIELD DRUGS TO FIGHT HEART DISEASE

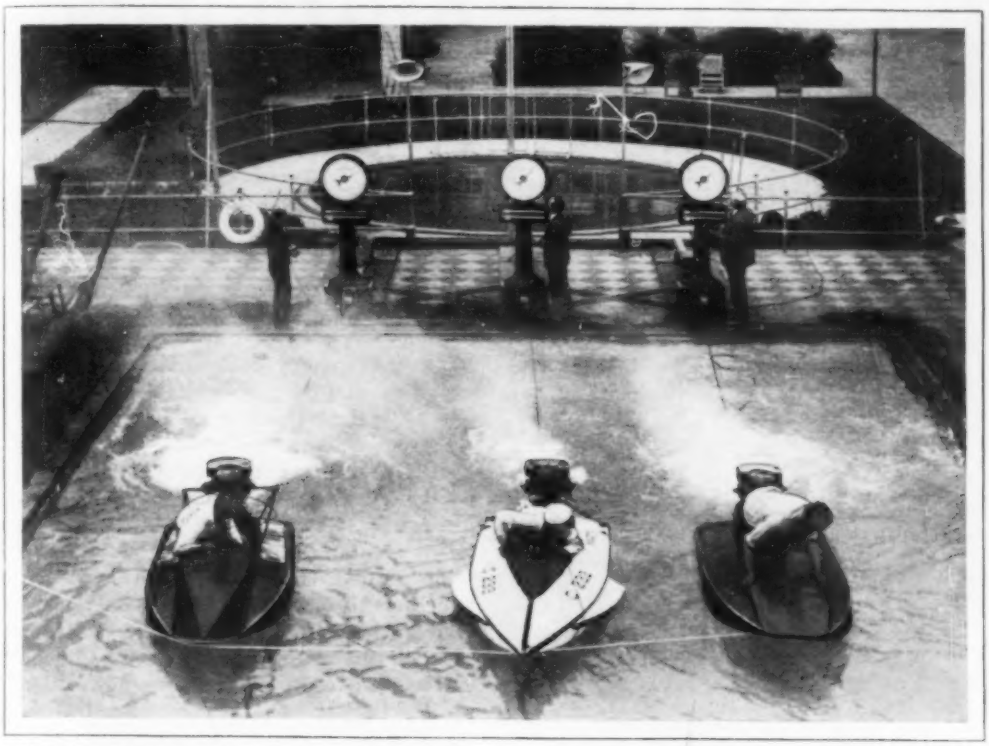
Venom of toads, for centuries used in Europe as a source of poison, and in China as a medicine, has been found to contain potent elements resembling drugs in therapeutic use today and may provide new weapons against heart disease. Doctors of Johns Hopkins University have isolated four kinds of chemical substances in crystalline form from the venom of a toad found in the river and lake regions of China. This toad secretes a poisonous substance in glands behind the eyes and the Chinese have long employed the dried venom in treating sores, sinus trouble, inflammation, toothache and bleeding gums. The venom is effective in stopping bleeding and promoting sinus drainage and some elements in it were found to have a pharmacological action quite similar to digitalis.

"PAINT DONKEY" SAVES MONEY ON TRAFFIC STRIPES

Painting the white stripes in the street which direct auto and pedestrian traffic in proper lanes and at intersections is accomplished in San Francisco by a machine called a "paint donkey." Hand-painted lines for traffic cost seven cents a foot, but the machine does the job for less than two cents a foot.

"Paint Donkey" That Marks White Lines on Streets for Pedestrians and Autos to Follow

BOATS RACE IN SWIMMING POOL WITHOUT MOVING



Here Is a Motorboat Race in a Swimming Pool; the Boats Were Attached by Cables to Apparatus Which Recorded Pulling Power, and the Boat with the Most Power Won the Contest

Racing tests of the fastest speedboats on the Pacific coast were held recently in a small swimming pool, the motorboats straining bow and bow with motors wide open, although in reality they were standing still. The boats were attached by cables to an apparatus which recorded their pulling power, and the winner was the craft that exhibited the strongest pull.

NATURAL GAS YIELDS DYES, PERFUMES AND RUBBER

By decomposing natural gas at high temperatures and recombining its constituents, products ranging from artificial rubber, anæsthetics and motor fuels to dyes, explosives and perfumes are being obtained, the department of commerce reports. The gas is heated to 1,800 to 2,200 degrees Fahrenheit to cause it to "crack" or break up into various substances which reunite as the gas cools to form new products. Under certain conditions, besides the materials already mentioned, carbon black is obtained. This is widely used in several industries.

COMBINATION LOCK FOR SPARE WHEEL IS THEFT-PROOF

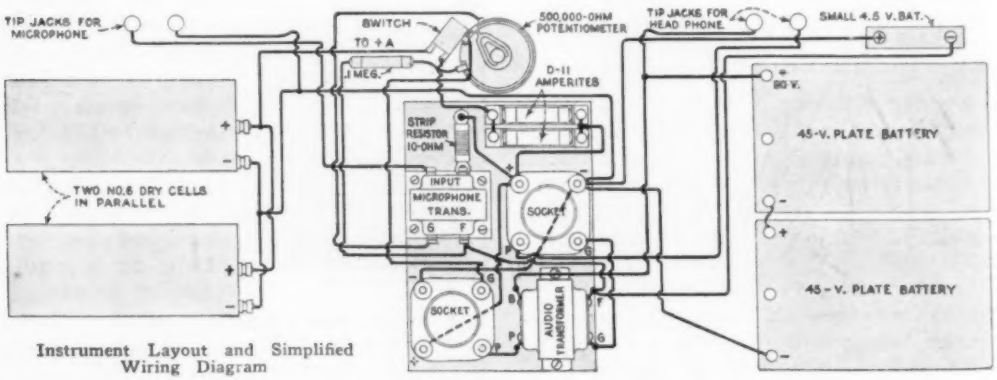
Operated like a knob lock on a safe, a combination lock for the spare wheel of an automobile is being used in England. The lock is fitted to the bolt that secures the wheel and locked in position by twirling the knob that can only be removed by setting at a code number known to the owner, and which cannot be discovered by touch. The external parts revolve freely, affording no grip for a wrench.

PORTABLE AMPLIFIER

THERE is no reason now for any deaf person missing his favorite opera or being unable to enjoy radio programs, lectures or other forms of entertainment. Perhaps one of the simplest and most powerful audio devices yet designed to aid the deaf is this compact amplifier recently tested in Popular Mechanics laboratory. The instrument employs two of the CX-12 tubes and is operated with two dry cells, a small C-battery and two 45-volt B-batteries of the variety used in portable receivers.

Originally designed for a writer who was becoming so deaf that he could scarcely hear a lecturer even when seated in the front row, this amplifier enabled him to sit in the rear of an auditorium without missing a word. This is a rather strong statement, but tests carried out with a member of the staff and several other persons clearly demonstrated that the claim was not unduly exaggerated. Anyone can build this device in the manner described and illustrated, and it is possible to make it even more compact by the use of type-199 tubes and smaller batteries. With a 4.5-volt C-battery for the filament supply, it could be easily contained in a vanity or camera case.

The original case, shown in the photo on this page, is 6 in. high, 7½ in. wide and 11¾ in. long, over-all dimensions, and is made from ¼-in. stock. The hinged



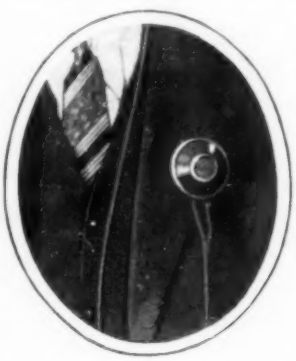
Instrument Layout and Simplified Wiring Diagram

AIDS DEAF

cover is exactly 1 in. deep. The case is divided into three compartments by means of four 1/16 by 1/2-in. brass strips. These strips are 9 1/2 in. long and are bent over 1 1/4 in. at each end. Two holes are drilled in the ends for wood screws, and the strips are mounted so as to hold the batteries firmly, as shown in the photo on this page.

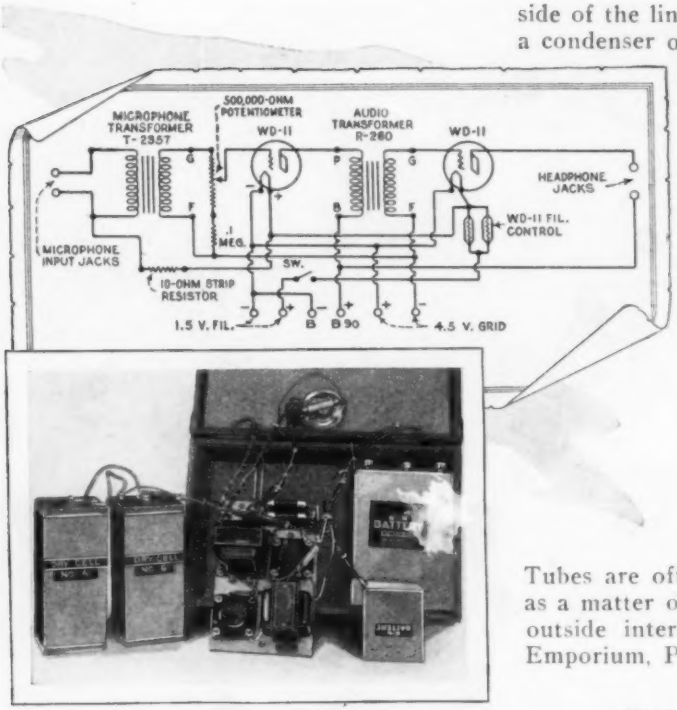
The simplified wiring diagram shows all parts in their relative positions; in the photo above the diagram, note the potentiometer knob for controlling volume and the cord-tip jacks for the headphone and microphone. These units are mounted on the cover near the hinge; the volume control used is a combination switch and potentiometer, the knob of the latter operating the switch. If the builder desires, he may just as well use a separate switch.

The few inexpensive parts that go to make up the amplifier are mounted on a wooden board, 3/8 by 4 1/4 by 6 3/4 in., to be screwed to the bottom of the case. The tube sockets are the spring-suspended type, and are mounted with their terminals in the position shown, for short and direct leads. The audio transformer is a new type with a ratio of 3 1/4 to 1, and the microphone transformer is a small inexpensive type designed for use with any single-button microphone. The 10-ohm strip resistor is mounted directly on one of the input terminals. All other instruments are as shown, and are specified in detail in the material list which is available to all who are interested in the device.



Use well-insulated flexible hookup wire for the circuit; cable the leads from the dry cells to the microphone tip jacks and the filament supply leads to the sockets. The leads from the microphone transformer to the potentiometer and those to the switch as well as the B-battery leads are separately cabled by lacing with string or heavy thread.

When the wiring is completed, insert the tubes in the sockets and plug in the microphone and headphone. With the latter in position, turn on the switch and advance the knob of the potentiometer until a swishing



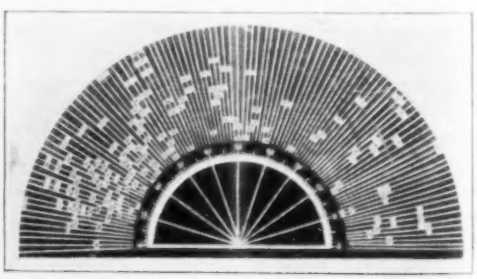
noise is heard. Sounds will now be picked up by the microphone and greatly amplified. The efficiency of the device will depend upon the sensitivity of the single headphone, which is a common radio type, and especially upon the microphone. Microphones range in price from about $8 to $50. For the tests, an inexpensive type was used and worked so well that most excellent results should be obtained with a costlier one.

Power-Line Antenna Effects

Interference from outside sources is, of course, best eliminated at the source. But this is difficult and often impossible. The next best thing is to prevent as much as possible from getting in the receiver. Most of the interference is due to electrical disturbances on the power line, caused by motors and similar devices, and it is a well-known fact that a. c. sets are more susceptible to this form of interference than battery-operated receivers. This happens because the power line acts as an antenna in some receivers regardless of whether a regular antenna is used or not. In most power-supply systems, one side of the line is grounded. If you take a condenser of any capacity from .010 to 2 mfd. and connect one side to the ground of the receiver and the other side to the ungrounded side of the line, a considerable amount of interference will be eliminated. The strength of the signal will decrease slightly however. In locations where neither side of the power line is grounded, better results will be obtained if two condensers are employed, one connected to each side of the line, while the other terminals are connected to ground. Tubes are often blamed for noise when, as a matter of fact, the trouble is due to outside interference.—Walter R. Jones, Emporium, Pa.

Wall Log for DX-Fans

A handy radio log for quick reference may be made as shown in the illustration. Made from black cardboard or bristol board, it is arranged in fan shape, to represent a dial. Each of the radiating lines drawn with white ink corresponds to the dial divisions on the set. When a station is tuned in, the call letters are written on a small piece of gummed paper and pasted on the correct line. The card may be of any size that will provide the necessary room for the station stickers and, when neatly made, it does not make a bad appearance on the wall near the set.—B. L. Kobel, Frankfort, Ind.

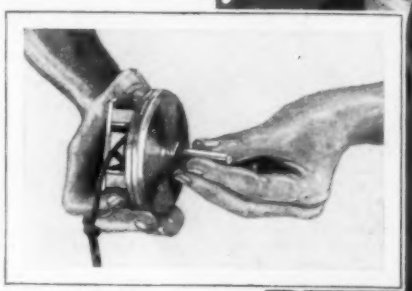


Cardboard DX-Log, Arranged like a Dial, Shows Tuning Points for Stations at a Glance

Broadcasting Heartbeats

A recently developed instrument for the physician is an electric stethoscope that picks up and amplifies the sound of a heartbeat so that it can be heard by a large audience. You can do the same thing on your radio receiver, if you can obtain the use of a loud-speaker unit.

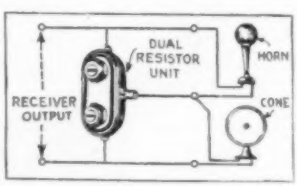
The unit acts as a microphone that picks up the sound vibrations and feeds them into the a. f. amplifier of your set. If your receiver is equipped with phonograph pick-up jacks, the task of connecting the unit to the set is simple. Otherwise, you will have to connect one wire of the unit cord to the grid of the first a. f. tube or the detector tube, and the other to one of the filament wires. When the unit is thus connected, and the amplifier turned on, you will be able to broadcast almost any sound through your loud speaker. This suggests a way of mystifying your friends at a party by doing your own announcing from a concealed point. To amplify heartbeats, place a short section of lead pencil or other rigid object so that one end rests against the diaphragm of the unit and the other is touching the chest over the heart. The heartbeats are conducted to the diaphragm through the stick. With the average receiver and a good speaker unit, the beats can be heard all over a good-sized room. Usually, the balanced-armature type of loud speaker makes the best microphone. It works as a generator of tiny currents, because the armature moves in the field of the permanent magnet, the generated current being picked up by the speaker coils and carried into the amplifier of the set. In addition to heartbeats, you ought to be able to hear your muscles move. The jaw muscles are particularly noisy. Rest the end of the stick on the diaphragm as before, and place the other end against the jaw, near the ear. Slowly tense the jaw muscles; and then relax them. If your set-up is sensitive, you will hear a low, rumbling sound like distant thunder. It will not be as loud as the heartbeats, of course. This is an interesting experiment to try on your friends.—Walter E. Burton, Akron, Ohio.



Insert Shows Short Stick Cemented to Diaphragm; Right, Station JAW Broadcasting

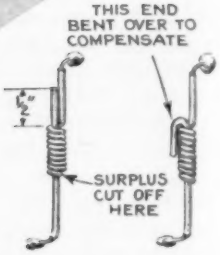
Blending the Tone of Loud Speakers

Those possessing a modern cone speaker and an old-style high-pitched horn may easily adopt the mixing-panel idea employed by broadcasters. The general purpose of a mixing panel for the home receiver is to obtain mellowness and depth with just the desired degree of sharpness for voice and distant reception. To do this, both speakers are connected in series across the output of the radio receiver, and each is shunted with a variable resistance. Both resistances should have a range of from 0 to 300,000 ohms for efficient control. Separate resistors may be used, or dual resistors mounted in a single unit.

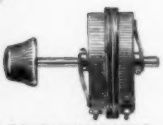


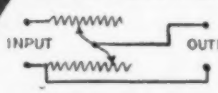
¶For further information on any radio construction article write to the radio department; this service is free.

TIPS *from the*



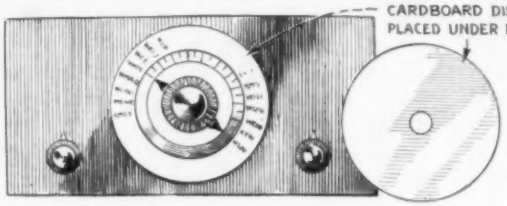
An Inexpensive Balancing Capacity Made from a Few Inches of No. 18 Insulated Bell Wire; Soldered Circuit Connections Are Shown at Top and Bottom

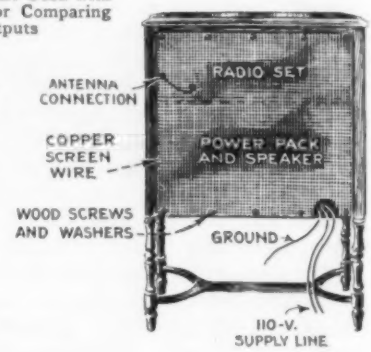


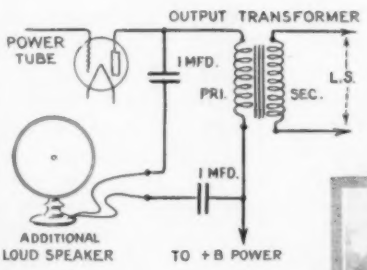


Two 5,000-Ohm Potentiometers on One Shaft Used with 0-to-100 Scale for Comparing Set Outputs

Connecting 45-Volt B-Battery in Series with a 90-Volt B-Eliminator to Obtain 135-Volt Output; Right, Copper Screen on Rear of Console Solves Antenna Problem in Apartment Buildings; Antenna Lead Is Soldered to Screen; It Provides Ventilation and Does Not Interfere with Speaker Operation



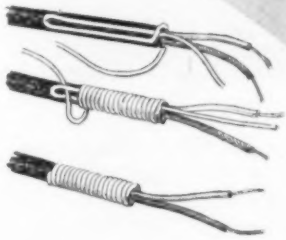




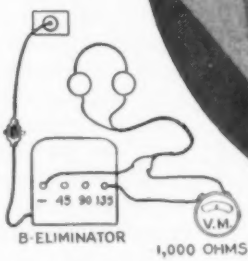
Left, Above, an Easy Method of Logging Any Set Equipped with Ordinary Flat-Type Dials; the Cardboard Disk Is Pasted on the Panel and Pointers Are Painted on the Dial to Provide Additional Logging Space on Lower Portion; Below, Adding Speakers to Sets Equipped with Built-In Dynamic Speaker; the Two Condensers and Connecting Wires Enable the Use of Four Extra Speakers on Sets Employing a 250 Power Tube

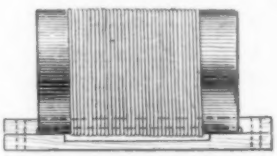
Right, Breaks in Insulated Conductors May Be Located by Means of Suitable Voltmeter and Sharpened Test Points to Pierce the Insulation; When Break Is Bridged, Meter Shows Deflection

RADIO LAB·

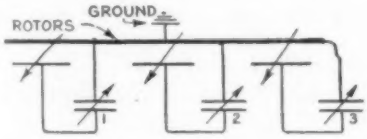


Above, Binding Lampcord to Prevent Covering from Unraveling; Right, High-Resistance Voltmeter in Series with Phones or Loud Speaker Connected across Newly Repaired B-Eliminator for Hum Test without Hooking Up a Receiver

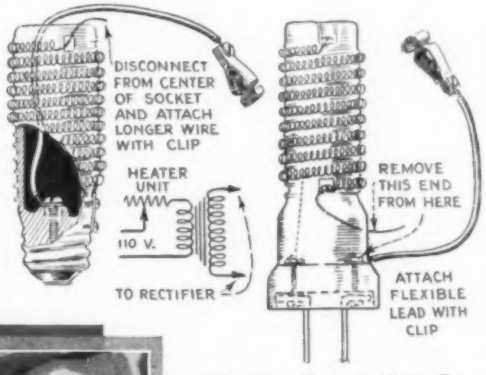


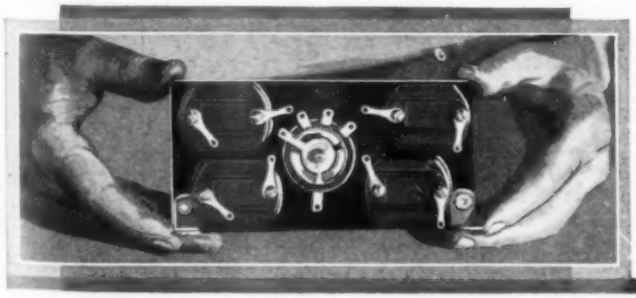


Left, a Clever Coil Mounting Devised by a New Zealand Experimenter; Two Pieces of Wood, ⅜ In. Wide and ¼ In. Thick, Are Required; a Groove Is Cut in the Lower Strip to Clear the Winding; the Upper Piece Is Also Grooved to Hold the Coil Form Firmly, and the Complete Assembly Is Screwed to the Subpanel; Below, Modern Ganged Condenser with Trimmer Condensers Nos. 1, 2 and 3 Connected across Each Tuning Unit for Balancing Purposes; the Heavy Line at Top Represents the Rotor of Each Condenser Which Has a Common Ground on the Condenser Frame



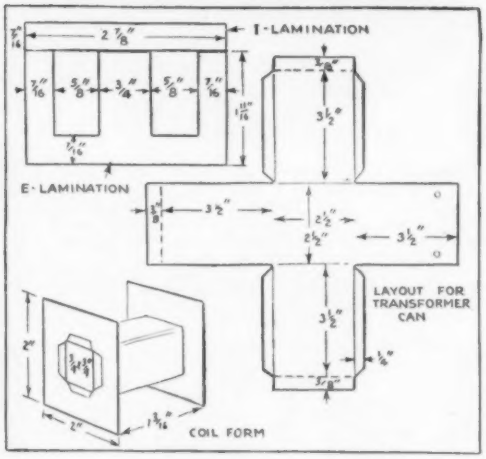
Right, Homemade Heavy-Duty Variable Resistors Made from Common Types of Electric-Heater Elements, Which Have a Resistance of About 20 Ohms Around 500 Watts and May Be Used in the Primary of Power Transformers to Reduce Output Voltage or Similar Purposes Where Heavy Currents Will Be Encountered


DISCONNECT FROM CENTER OF SOCKET AND ATTACH LONGER WIRE WITH CLIP
HEATER UNIT
110 V.
TO RECTIFIER
REMOVE THIS END FROM HERE
ATTACH FLEXIBLE LEAD WITH CLIP



Left, Tone-Control Unit Enables Operator to Change the Quality at Will; Fixed Condensers, from .00005 to .001 Mfd., Are Mounted on Bakelite Panel with a Four-Point Switch, One Side of the Condensers Being Connected to a Common Lead; the Switch Connects One at a Time across the Secondary of the Audio Transformer

Giving the Old a New



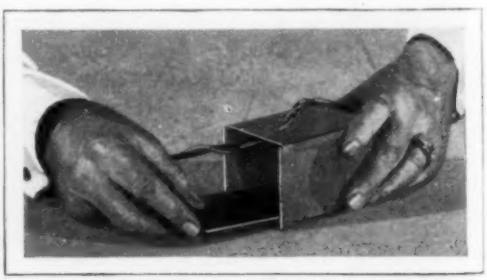
A FEW months ago the 171-tube in the last audio stage rated as the ultimate in radio; today, it is in almost the same class as the variometer in broadcast receivers. With the coming of the 245, which is even more efficient than the earlier 210, and at considerably lower plate voltages, the whole business of power amplification has reached a new stage of development.

Now, then, the problem is to take the old set with its 112 or 171 and give it a 245 voice, and the purpose of this article is to describe a self-contained adapter that can be plugged into the last audio socket without making a single alteration in the wiring of the set. This unit can be used for either one or two tubes, although, for most purposes and for most built-in power packs or B-eliminators, a single tube will be quite sufficient.

The 245-tube cannot be operated from the ordinary filament lighting transformer without serious overloading, so a special filament transformer is required.

The laminations, or core material, constitute the knottiest problem, but since they can be bought ready-stamped, it is hardly worth the time and trouble to cut them out with tinsnips and hacksaw. Possibly it may be found that certain types of old transformer cores will answer the purpose, and a slight variation in dimensions of the core is permissible.

Having the core material, about 55 pieces each of the "E" and "I" laminations being sufficient for a ¾-in. core, a tube or core is required on which the secondary and primary are to be wound. This coil tube is easily made, as shown in drawing on this page, by wrapping a layer of 1/32-in. fiber around the center member of the stack of laminations, and somewhat longer. When the strip has been properly fitted, it is removed and a line is scored at each corner. The core is then bent into shape so that the corners will be square, replaced on the stack of laminations, glued and allowed to dry before the next step. When the core has



Pieces of Bakelite Inserted in the Can to Wedge the Transformer in Position

Old Set by Voice

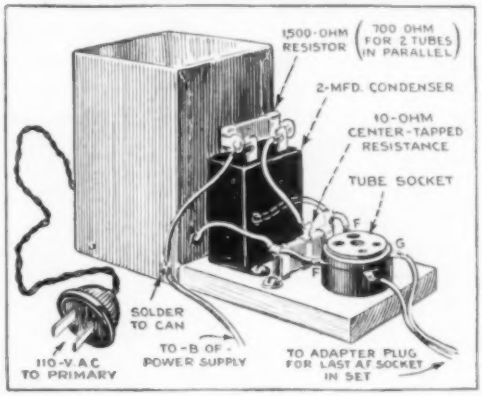
James Arms

dried, two square flanges are made to slip over the ends of the core. The corners of the core are cut open, and the free ends turned up and glued to the flanges. When the glue has dried, the next thing is to wind on the primary, which consists of 880 turns of No. 29 d. s. c. wire. If No. 29 wire is not available, No. 28, which is slightly larger, may be used.

There are various ways of winding coils, but since accuracy is highly desirable, a coil winder equipped with some form of counter is recommended. However, the use of a hand drill in combination with a revolution counter offers a very fair substitute.

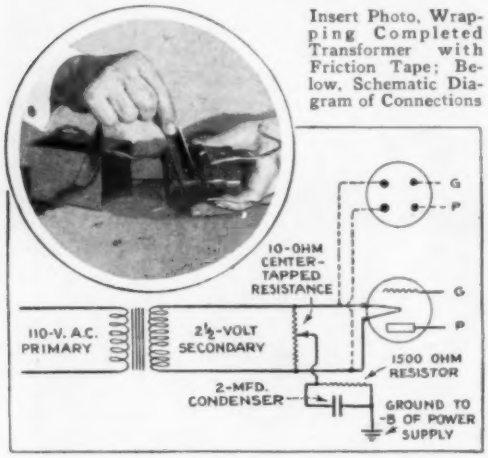
When the primary has been wound on as uniformly as possible, wrap on a layer or so of tape and proceed with the secondary. Owing to the low voltage and high current drain, this winding requires heavy wire, and since this is sometimes difficult to obtain and always hard to wind, a substitute is offered. Take two pieces of No. 16 d. c. c. wire, about 15 ft. long, and solder them together at one end. Then wind on 20 turns of this tandem winding, and, when finished, cut off the surplus wire and solder the remaining ends together. This arrangement has the same effect as a single winding of heavier wire.

Leads Soldered to Wire Terminals; These Taped Connections Remain Inside the Can When Assembled



The completed coil is wound with tape, and then the core is built up by inserting, from alternate sides, the "E" and "I" laminations. When as many laminations as can be packed inside the core have been inserted, the whole is either bolted or clamped together. The finished transformer, which delivers around 4 amp. at 2.5 volts, is "canned." The can is made from either tin, brass or other sheet metal, about 1/32 in. thick, and cut according to the pattern given in the illustration on page 126. Two pieces of scrap bakelite were used inside the can at bottom and front for wedging the transformer tightly in the container. It will be observed that three sides of this container are longer than the other. In the model illustrated, the whole outfit was mounted on a piece

of board, ⅜ in. thick, 2½ in. wide and 6 in. long, which makes it possible to in-



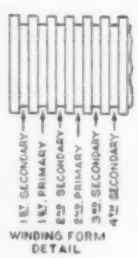
Insert Photo, Wrapping Completed Transformer with Friction Tape; Below, Schematic Diagram of Connections

sert the complete adapter unit into some corner of the set.

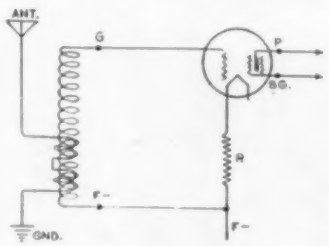
The wiring for the circuit is illustrated in the drawing on page 127, and that's about all there is to it. The last tube in the set is removed and the adapter is plugged in its place. In the case of sets in which there is a push-pull audio end, two tubes will be required, with separate plugs for each tube in the amplifier unit.

Marking Location of Tubes in Set

In modern receiving sets with several types of tubes with filament voltages varying from 1.5 to 5 volts, it is quite important that the tubes are placed in their proper sockets. Many manufactured sets have the sockets clearly marked, while others depend on a chart which is easily lost. For instance, if one makes the mistake of inserting a UX-226 tube, requiring but 1.5 volts on the filament, in the socket intended for a UX-171, 5-volt tube, the result will quite likely be a burned-out tube. It is a simple matter to mark the tube socket or the chassis adjacent to the socket for the type of tube with a small brush dipped in some quick-drying lacquer.

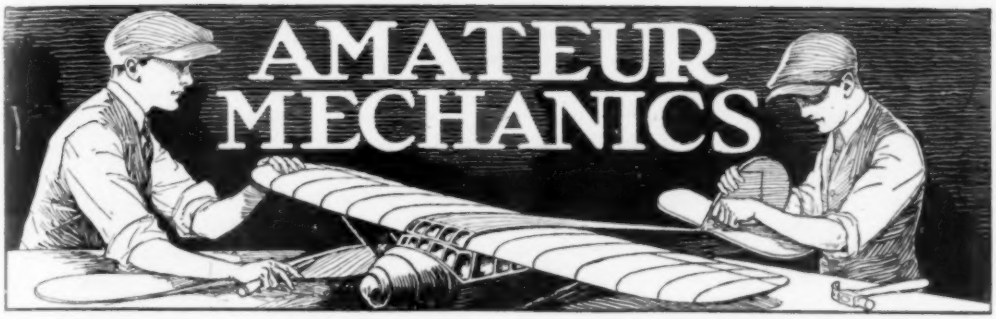


WINDING FORM DETAIL



Improving Selectivity of All-Wave Sets

The writer recently constructed a short-wave receiver and added plug-in coils to extend the wavelength range up to 600 meters. An untuned screen-grid r.f. stage was employed ahead of the regenerative detector as is common practice. At first, a 10,000-ohm fixed resistor was used to couple the antenna to the grid circuit of the screen-grid tube. The selectivity was good on the distant short-wave signals, but separation of stations in the regular broadcast band with the larger coils was almost out of the question. This was remedied in a simple manner which, I believe, will be of interest to many others having the same difficulty. The idea is an arrangement whereby the grid circuit remains untuned but is inductively coupled to the antenna. The winding form was a piece of hardwood, 2 in. long by ¾ in. in diameter. Fourteen grooves, 1/16 in. deep, were cut in the form, spaced equally over its entire length. The job may be done on a lathe, or if ¾-in. dowel stock is available, the slots may be cut with a hacksaw. The secondary winding consists of 600 turns of No. 36 enameled wire and is wound as follows: 50 turns each in the first, third, fifth, sixth, seventh, eighth, ninth, tenth, eleventh, twelfth, thirteenth and fourteenth grooves. The primary, or antenna coil, has 100 turns of the same-size wire wound in the second and fourth grooves, 50 turns in each. The first section of the secondary is wound first, then the first section of the primary, then the second section of the secondary, and so on until the form is completed. Beginning with the fifth secondary section, the wire need not be cut after a groove is finished but the winding is continued to the end. The diagram shows the position of the primary winding near the filament end of the secondary. Alternating the primary and secondary in this manner results in better coupling.— R. Wm. Tanner, Charlotte, Mich.

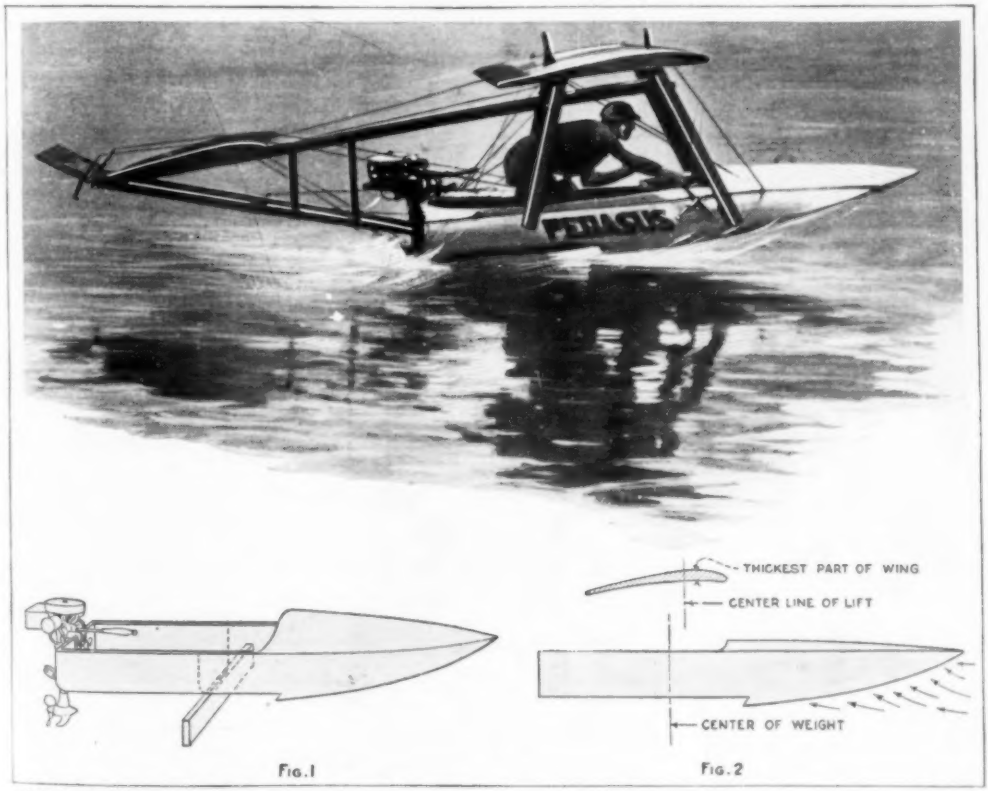


An Outboard "Leaping Lena"

By DICK COLE

THE OUTBOARD motor is forever performing new stunts. The illustrations depict its latest—driving a real "Leaping Lena"—a sport that is guaranteed to give a tingling thrill to the most bored of outboard racers.

"Pegasus," the craft shown, consists of a light racing boat fitted with airplane wings and powered with a sturdy outboard motor. This contraption actually flies for short distances, sometimes after the style of a mammoth flying fish. When driven into a fairly fresh breeze, it plays hop, skip and jump over the waves, the pilot



Photos Courtesy Harrison Fraser

All the Thrills of a Ride on the Hurricane Deck of a Bucking Broncho Are Given the Pilot of This Novel Flying "Seahorse," a Craft That Will Provide New Sport for the Outboard Fan

experiencing a series of sensations that cannot be duplicated by any amusement-park thriller. Playing jockey to a flying seahorse is a sport unto itself.

No doubt many outboard fans will wish to duplicate the performance of "Pegasus." Few, however, will desire to convert their one boat permanently into a mechanical flying fish, for, while this craft is decidedly novel, it has its disadvantages as a permanent design. It is a menace to other crafts on narrow waterways. It is clumsy to dock. A stiff crosswind perils the craft and the pilot. On a long cruise, the "drag" of the airplane wing retards the maximum speed of which the unadorned boat is capable. The winged boat is simply a novelty for sport and amusement, on waters where it can safely be used. Boats are so variable in design and in performance, that it is impossible to outline any fixed method of construction applicable to all models. To make a perfect "mechanical flying fish," one would have to make a special hull and delve deeply into the laws of aerostatics, and this, of course, is beyond the scope of the amateur outboard fan. However, a little timely advice will aid the ambitious outboarder to ape the fish that play "on the road to Mandalay."

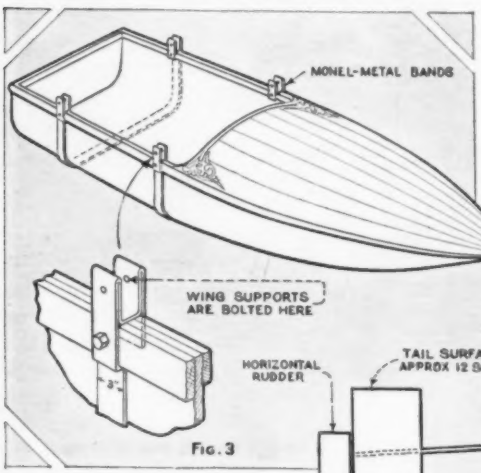


Fig. 3

The first requisite is a boat less than 100 lb. in weight and capable of a speed of at least 30 miles per hour. The next thing is to find the center of weight of the boat with the motor attached. A simple way is to balance the boat on the edge of a wide plank, Fig. 1. After the point has been found, it should be distinctly marked with chalk or paint.

The next thing is to procure an airplane wing. Very few would care to build a wing, but a suitable one can often be had from another source. Back of the hangars on the local aviation field are usually some junked fuselages and wings, and a 12 or 15-ft. section of an old wing can often be had for the carting away. In any event, it can be bought for a couple of dollars. The section must have the same curvature throughout its length, otherwise two shorter, symmetrical sections must be had.

The wing is mounted about 4 ft. above the gunwales of the boat, and the center lift of the wing must be slightly forward of the center of weight of the boat. One can estimate closely the center of lift by visualizing the cross-section of the wing, and by referring to Fig. 2. Non-technically speaking, the center of lift is about 6 in. back of the thickest part of the wing.

On a boat of the sea-sled type, the wing is located farther back than in the case of a pointed-bow boat, since the inverted bottom of a sea-sled affords a few additional pounds' lift forward.

The exact method of attaching the wing to the boat must be left to the builder's ingenuity. The design of wings and of boats is too diversified to lay down any

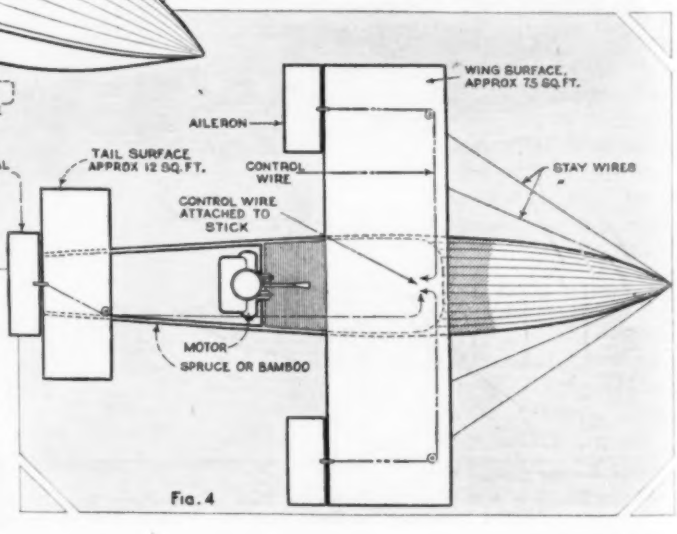
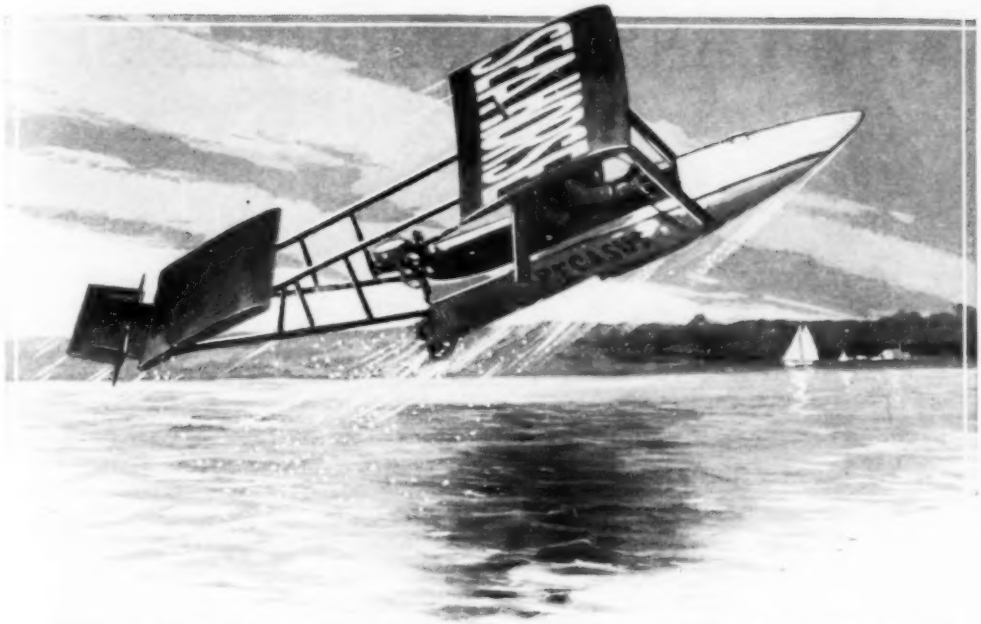


Fig. 4



"Pegasus" in Flight; This Photo Gives a Good Idea of the Heights to Which the Ambitious and Skillful Rider of the Flying Seahorse Can Rise—after His First Course of Spills

fixed rules. The wing must not be attached so as to lift directly on the gunwales only. The resultant strain of a sudden gust of wind might rip off the gunwales or open seams in the planking. To safeguard against this, it is well to put two 3-in. bands of fairly heavy sheet metal completely around the bottom of the boat, as in Fig. 3. Monel metal is especially recommended.

Spruce, streamlined, is recommended for the supports. The tailpiece, possibly with the horizontal rudder already attached, comes from the same source as the wing. The photographs illustrate very clearly the approximate position and the construction of the tail assembly, but the exact angle of the tail can best be determined by experiment. The lower pieces of the tail-support frame are screwed securely to the gunwales or to the transom. These pieces must be cocked upward sufficiently to prevent the tail from dragging in the water when the bow lifts. The framework of the tail should be made of clear spruce or of Calcutta bamboo.

The photographs show no ailerons attached to the wings, but later experiments with "Pegasus" proved that ailerons were desirable to maintain lateral balance. Without them an occasional sideslip is inevitable, with possible damage to the wing and danger to the pilot. The main wing should be mounted so it can be tried at various angles.

The pilot should proceed cautiously when first trying out his winged craft, and the first tests should be made on smooth water. The pilot should have his own weight well ahead of the center of weight. After the boat has gained its maximum speed, the pilot slowly moves his weight back. The bow rises, and the onrushing air hits the wing surface at a more effective angle, lifting the craft clear of the water. The moment the propeller is in the air the motor races, so provision must be made to throttle down the motor instantly to prevent damage. As soon as the propeller is out of the water, the forward thrust ceases, the drag of the wing checks the momentum of the craft and it glides down to the surface of the water.

The method of operating the control cables must be left to the option of the pilot. They can be attached to a "stick" as on an aeroplane. The horizontal tail rudder will come in for very little use, as the pilot soon learns to shift his weight involuntarily to maintain longitudinal balance. Skillful operation of the ailerons will be acquired from practice.

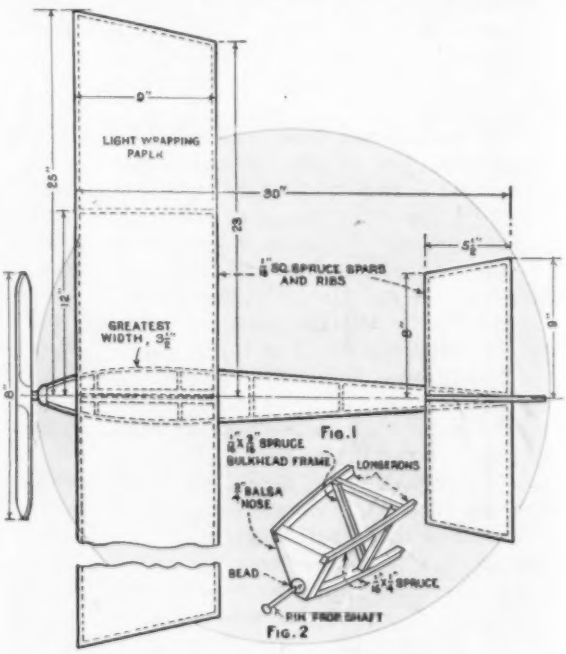
AIRPLANE KITE RELEASES

WHEN this airplane-model kite was having its first try-out, a near-sighted old lady rushed excitedly into our corner drug store and cried: "Lookout everybody! A big airship's going to crash right down on us."

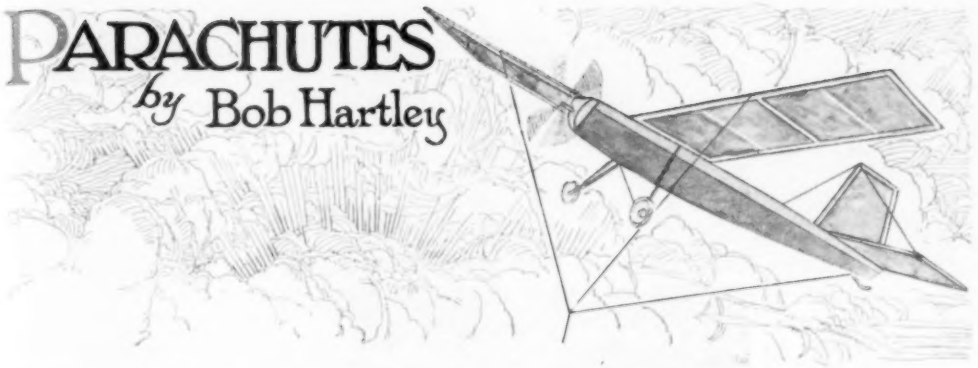
And in fact the kite, zooming around in spirals against an overcast sky, did look for all the world like a plane in trouble. The strange maneuvers were caused by manipulation of the string; in a few minutes it pulled out of its spin and soared gracefully, with a dip now and then at the will of the operator.

Making this kite is far simpler than building a model airplane, and when it is completed, you have an infinitely stronger job than any of the rubber-motored models. It is not necessary to build for lightness, and although the original of the model weighs less than 5 oz., it is surprising what a load a brisk breeze will lift even with the limited wing surface of the kite.

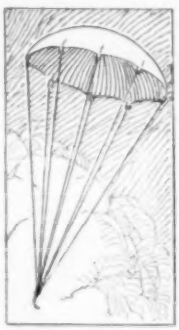
Spruce is used throughout, with the exception of a balsa nose and tail-piece, and propeller, and even these can be of white pine. Begin with the V-shaped fuselage, assembling the two top longerons with the ¾-in. balsa nose and tail blocks shown in Figs. 2 and 3, and the intermediate crosspieces. Use ⅛ by ¼-in. spruce longerons at the top corners of the fuselage; set in the central crosspieces across the two and ambroid them in place. Next draw the ends of the longerons together and secure them to the balsa nose and tail blocks, notching them in place here as shown in the drawings. It is important that the top side of the fuselage remain flat, as shown in the side



PARACHUTES
by Bob Hartley



elevation, Fig. 4. In order that it may not be bent to a curve by the bottom longeron, the latter is only 1/16 in. thick so that it will bend readily without imposing any strain on the rest of the fuselage.



Secure the bottom longeron to the tail block with ambroid and bind with tough thread, then build the V-shaped bulkhead frame as you work toward the nose. The bulkhead frame members are notched at the top to set against the longerons and ambroided in place. The other ends, at the bottom of the "V," are also ambroided and bound together and to the longerons with thread. The bulkheads are spaced longitudinally as shown in Fig. 4.

Note that the wing has a pronounced dihedral angle, and the frame is made in two halves, joined at the center line as in Fig. 7. To insure strength and protection against crashes when launching, the corners of the wing and stabilizer frames are lapjointed, and firmly secured with ambroid and thread binding. Half of the lap is cut in each piece, so as to leave the joint the same thickness as the spars. The two ribs midway in each half of the wing are half-lapped; that is, the ends of the ribs are cut down but not the spar, which would be weakened by the process.

Join the two halves with a 4-in. section of heavy, stiff wire, bent to the required angle and secured with ambroid and thread. This wire is used on both leading and trailing spars. In order that the wing may sit level on the top of the fuselage, the underside of the spars are built up with balsa blocks where they join.

The stabilizer (Fig. 1) is very simply made, using the same-size material as the wing and only one rib in the center. For

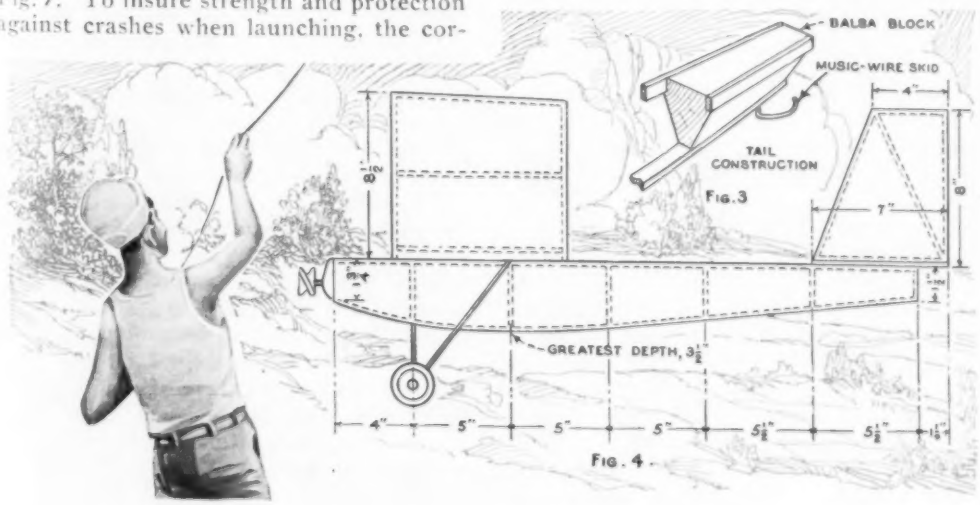


FIG. 4.

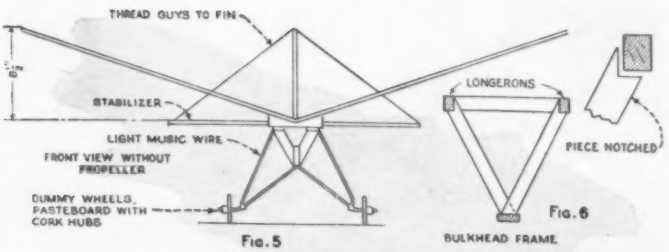
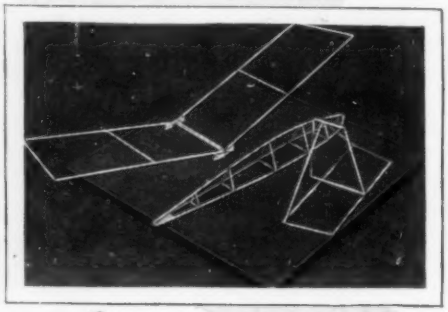
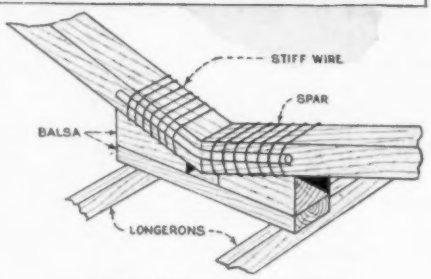


Fig. 5

Fig. 6

BULKHEAD FRAME





METHOD OF MAKING DIHEDRAL WING

Fig. 7

the fin, the writer used lighter pieces, ⅛ by 3/16-in. spruce, with a diagonal brace. None of the fin joints need be lapped.

You need not follow model-airplane practice in making the propeller. On the contrary, the prop should be made large and conspicuous, with wide blades and moderate pitch so that it will not turn too fast to be seen. Balsa is good material, but white pine will also be satisfactory. When completed, sandpaper it well, give it a coat of dark stain and cover about half of the blades with tinfoil, or better, if you happen to be on good terms with a sign painter, gold leaf. The latter is very hard to apply well, but the tinfoil can be laid on with a thin coating of glue, mucilage or shellac. The effect in the sunlight, as the whirling blades reflect the rays, is certainly "keen," as the boys say.

For fabric, the writer used ordinary lightweight brown wrapping paper from the grocery store. It is tough enough and at the same time light enough for all purposes, and the dark tone makes the plane more easily visible high in the air. The first experimental kite that was built was made with all balsa fuselage and spars and was covered with bamboo paper. This was not a success, as the wind simply blew holes in it, and it folded up like a limp handkerchief in the air. So don't try to build the kite too light. Follow the instructions as given.

The paper should be put on the bottom side of wing and stabilizer and on either side, or both, of the fin. Apply a thin coating of glue on the spars and end ribs with the finger, which spreads it more smoothly than a brush, and draw the paper tightly from end to end, pressing down on the end ribs, and then from front to back. An unusually neat job can be done with this kind of paper.

It will be necessary to cover each side of the fuselage with separate pieces of paper, and, in each application, always pull from end to end first, then to the sides.

You will note that the wing is covered after the two halves are assembled. This is to make it easier to bind the frames together. If you have patience, however, you can reverse the order and, perhaps, make a better job of the papering.

A dummy landing gear adds to the effectiveness of this novel kite, and is built of light music-wire struts with pasteboard wheels and cork hubs. The wheels, of course, need not turn on the axles, and are ambroided in place. Attach the wing-and-tail assembly to the fuselage with ambroid and thread.

The three-point string arrangement keeps the craft steadier than a two-point, as on conventional kites. Two ends are tied to the leading spars at the central ribs and the third to the tail skid. The proper length and adjustment should be determined by experiment. On the original, the apex of the three strings was just about even with the nose and 12 in. below it. Varying conditions may demand a different adjustment.

While the parachute idea is not new

this adaptation lends new thrills. Send the parachute up with the kite, instead of after it. Hang it at the apex of the tie strings.

A parachute in the true shape, or approximating it, can be made according to the diagram, Fig. 8. When complete, it is somewhat the form of an inverted saucer. One slit is made to the center and the edge is lapped over about ½ in. Seven other slits, 1 in. long, are made and lapped over about ¼ in. The strings are secured by strips of gummed paper pasted over the laps at the edges, and the ends of the strings (light thread should be used) converge to a bent pin. The point of the pin should have a wide angle, so that it will flip off the cord readily when the string is jerked, or snapped with the finger.

This kite is flown much the same as the standard types, except that it may be necessary to make the tie cords longer or shorter in order to vary the angle at which it meets the wind. Adjusted as described, the original rose nearly directly overhead on 600 ft. of cord.

A little experiment will probably be found necessary in order to determine the proper length of the hook on the parachute pin, and the angle to which it is bent. The original worked very well when bent to the angle given in the drawing. More elaborate arrangements of releasing the parachute can be worked out, of course, one of the most obvious being to hang the parachute by means of a trigger arrangement which will be released by a "messenger" in the shape of a light aluminum or brass tube sent up the string. The rate at which the messenger travels upward can be increased by fitting it with tin or light-brass propeller blades, soldered onto the tube so as to make it revolve. If this is done, brass or tin will have to be used for the tube, since it is difficult for the amateur to solder aluminum. If care is taken in adjusting the parachute and in releasing the kite when starting to fly it, it will be found that the simple arrangement shown will answer. A small weight tied at the junction of the parachute strings helps it to descend more steadily.

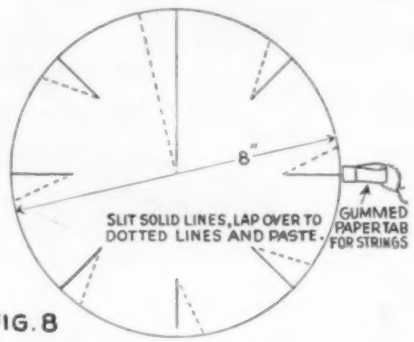


FIG. 8

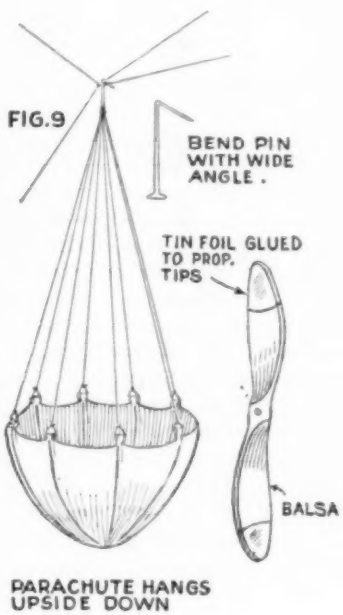


FIG. 9

PARACHUTE HANGS UPSIDE DOWN

LOG SKIDS AID IN GETTING CANOES PAST DAM

Getting a Loaded Canoe Past a Dam Is Simple with the Methods Shown in the Photos

A dam across a stream interferes badly with canoe traffic, and is quite a nuisance to the canoeist with a heavily loaded craft, as it means unpacking and portaging around the dam. How this problem was solved in one case is shown in the photos. For canoes coming downstream, two peeled and smoothed logs were spiked to the dam, just under water and parallel to the current flow, with their lower ends driven into the bed of the stream. Going down the canoe is pointed between the logs, and the current carries it over the dam and down the logs as on a chute. For going upstream, a track of peeled and smooth logs is laid on the bank, from below to above the dam. Two men can easily skid a loaded canoe along this track, as shown in the lower illustration. —M. E. Cowen, Cresson, Pa.

Hardening Small Tools

The hardening of small tools, such as chisels, etc., usually somewhat of a mystery to the home-shop worker, is in reality very simple. When tool steel is heated to a bright red and plunged into water or oil, it becomes hard, too hard, in fact, for ordinary use, for in this state it is brittle and apt to break on the slightest provocation. It is necessary, therefore, to "temper" the hardness to a point where the tool will be sufficiently hard to cut properly, yet tough enough to stand up without breaking. This tempering, fortunately, is an easy matter. Taking a cold chisel as an example, it is grasped in a pair of tongs and heated to the proper heat for quenching in water. Since there is a wide variety of tool steels, and since the "proper" quenching point varies for each, it might seem to be a difficult matter for the amateur to determine when to quench. Experience, of course, soon teaches this, but there is a simple test which anyone can apply with good results. Hang a small magnet on a piece of string near the forge or furnace where the tool is heated. As the tool grows hotter, pull it out of the fire from time to time and bring it near the magnet. When the hot tool ceases to attract the magnet, quench it. To temper the chisel, take a piece of emery cloth and polish the "business end" of the tool. Now take a piece of scrap iron, heat it to a good red heat, pull it out of the fire, and rest the chisel against it, about 2 in. back from the cutting edge. Watch the polished part of the cutting end closely, and soon you will

see colors begin to appear on the surface, as it grows hotter. First a faint yellow, blending into straw, then light brown, dark brown, purple and blue. When the color on the polished end reaches the dark blue, quench the whole tool in water. If the tempering heat is too high, the colors will run up the point of the tool too fast and close together. If this happens, dip the end in water and draw out quickly, when the colors will come more slowly. Different tools are tempered or "drawn" to different colors. Lathe and planer tools, for example, are drawn to a light straw (430° F.) or to a medium straw (450°); small drills and wood chisels to a brown (500°); center punches, scratch awls, wire cutters, screwdrivers and axes to a purple (530°), while cold chisels range from purple to dark blue (600°), depending on the purpose for which they are used.

Tinfoil Substituted for Small Mirror

A pocket mirror is often used to reflect light into small openings, but if a mirror is not handy, a piece of tinfoil taken from a cigaret package makes a good substitute. The sheet is doubled and pressed over a smooth disk, the overlapping ends being brought together to serve as a finger grip. A high polish on the foil can be obtained by rubbing it over a soft cloth, and it will reflect light nearly as

Improvised Mirror, Made from Tinfoil, for Reflecting Light into Small Places

well as a regular mirror.—Frank W. Bentley, Jr., Missouri Valley, Iowa.

Old Auto Hood Makes Good Brooder

Old Auto Hood with Ends Boarded Up Makes Comfortable Coop for the Chicks

By boarding up the ends of a discarded auto hood and providing a suitable floor, a neat, clean coop can be made for the chicks. Strap hinges are used to fasten the floor to the side, which enables one to clean the inside when necessary. Besides being sanitary and waterproof, this coop is comparatively light to carry.

Making "Close-Ups" with Small Camera

Those who use an ordinary small camera frequently find that it is impossible to get close enough to a subject to get the size of image desired, even though a portrait attachment is used on the lens. However, by using two or even three or more portrait attachments, one directly over another, the focus of the camera lens can be shortened so that a very large image is obtainable. Adhesive tape can be used for holding the attachments together. In this way it has been found possible to obtain large-scale photos comparable in size even with those made with a low-power microscope.—William C. Vestal, Redlands, Calif.

¶To prevent children from sounding your auto horn when the car is parked in the street, cut it into the ignition-switch wiring so that it can be used only when the motor is running.

Why Not Turn That

IT REQUIRES a good deal of labor to shape accurately even a small boat hull if the usual methods are followed, and simply sawing out the piece and chamfering the lower corners, after the manner of many commercial toy boats, does not produce a hull that suits the taste of the modern small boy. If the hull is shaped on a turning lathe, however, the work is quickly done, and the natty lines satisfy the most exacting youngster, even if they would not please a yachtsman.

Center on the lathe a piece of 4 by 4-in. pine, 14 in. long, and turn it to a cylinder 3⅜ in. in diameter. Then shape it to a smooth streamline profile, with the stern end (at the live center) 2 in. in diameter, and the over-all length 11½ in. The greatest diameter is 4½ in. from the bow. Sand it glass-smooth, and point as sharply as possible without breaking off the end.

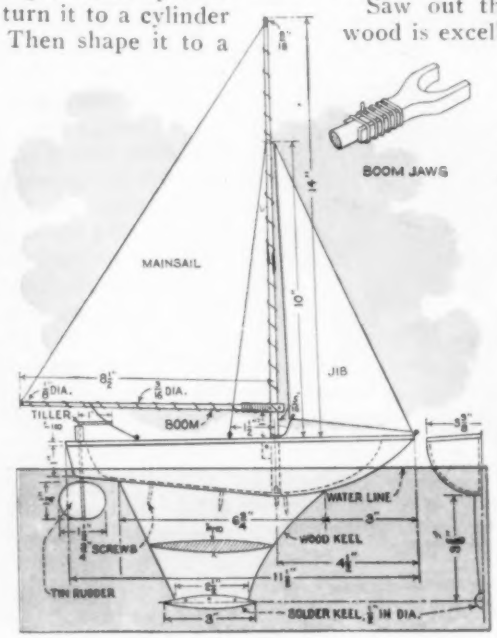
Remove the work from the lathe and break off the waste ends. With the grain of the wood vertical, as shown in the head photo, clamp the piece to a bench, taking care that the center, at each end, is at the same height from the bench. Resting one leg of dividers or compasses on the bench, set them to the center height and scribe lines along the sides. Guiding on these lines, rip the two halves apart.

This ripping is not difficult, even though the rounded piece is not easy to hold, for it can be held on a sawhorse with the knee while the stern is ripped. Then clamp the saw handle in a vise, with the teeth uppermost, and pull the piece back and forth with the hands, cutting first from one side, and then from the other. Thus, two good hulls are obtained from a single piece.

Now saw the stern at a slight angle with the deck line, and hollow the inside with a gouge, leaving ½ in. of stock at the stern, ¾ in. at the bow, and ⅛ in. elsewhere. Nail a ¼ by ½-in. beam across the hull 4⅝ in. from the bow, against which to fasten the mast.

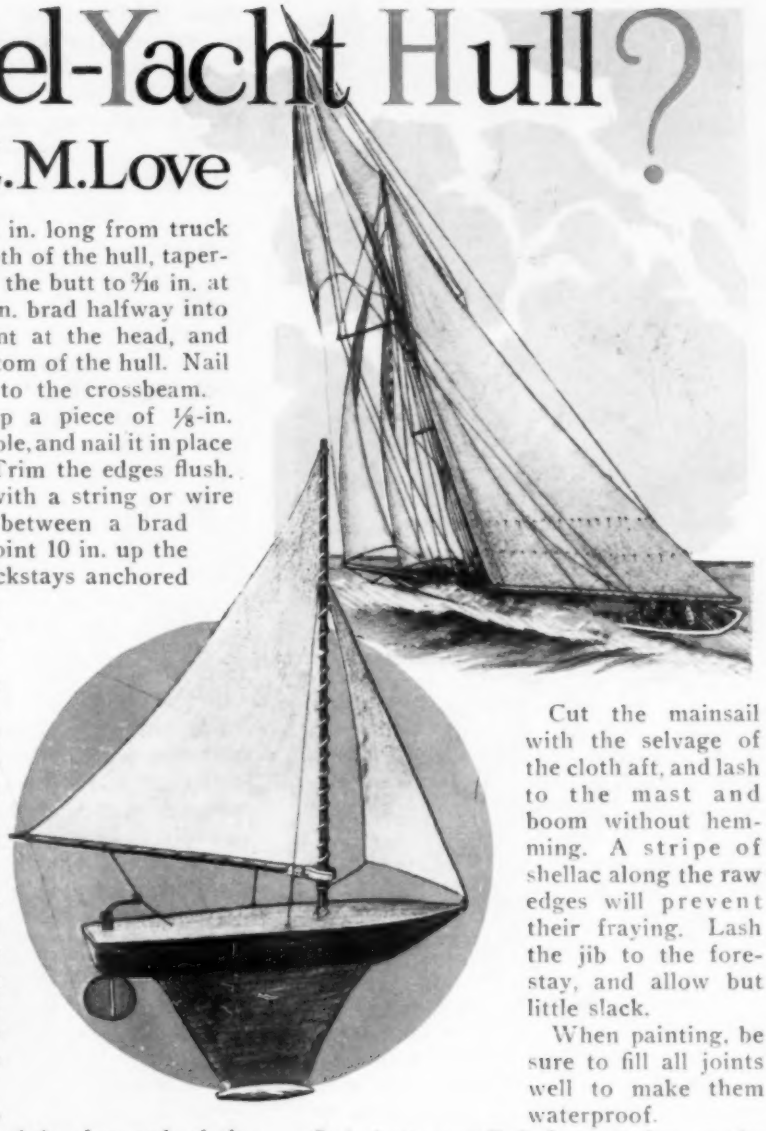
Saw out the keel (⅜-in. hardwood is excellent) and fit it to the hull. Work down the edges until the streamlined section shown is obtained, a matter of a few moments if a sanding disk is available. Attach it to the hull with three ¾-in. flat-head wood screws driven from the inside.

The keel weight is chiseled or cast from lead or solder. Slit one side to fit the wooden edge, and drive three ½-in. brads through solder and wood to keep it in place. Scrape it smooth.



Model-Yacht Hull?

by E.M.Love



Make the mast 14 in. long from truck to deck, plus the depth of the hull, tapering it from 5/16 in. at the butt to 3/16 in. at the tip. Drive a ¾-in. brad halfway into the butt, file a point at the head, and force it into the bottom of the hull. Nail or screw the mast to the crossbeam.

For the deck, rip a piece of ⅛-in. stock, bore a mast hole, and nail it in place with ½-in. brads. Trim the edges flush.

Brace the mast with a string or wire forestay stretched between a brad in the bow and a point 10 in. up the mast. Add two backstays anchored to brads driven 1½ in. aft of the mast, in the deck edges.

The rudder post and tiller are of baling wire, entered through a hole bored in the solid part of the stern. Solder to the wire an oval rudder snipped from tin, flowing enough solder to cover the rudder post. Make a wooden bead ½ in. long to hold the tiller above the deck.

Drive a brad into the deck, centering 1 in. forward of the tiller end, to which the tiller is secured with a rubber band drawn tightly enough to hold the rudder straight.

The mainsail boom is 3/16 in. in diameter at the center, tapering to ⅛ in. at the ends. Lash to the forward end a yoke to fit around the mast, and tie to the mast loosely enough to allow the boom to swing freely. Tether the boom with a string to the tiller, so that the boom end can swing 2 in. over the side. It will move the rudder enough to prevent the boat from veering and running before the wind.

Cut the mainsail with the selvage of the cloth aft, and lash to the mast and boom without hemming. A stripe of shellac along the raw edges will prevent their fraying. Lash the jib to the forestay, and allow but little slack.

When painting, be sure to fill all joints well to make them waterproof.

It is just as well, before putting on the deck, to apply a heavy layer of white lead or thick paint around the edges of the hull, where the deck is to fit, then nail the deck in place while the lead or paint is still soft. Since the rudder post comes through solid wood, there is no need to take any precautions at this point, but the keel can be bedded to the hull with white lead and the screws dipped in white lead before driving them into the keel. The hull should be painted in two colors, and the deck, mast and boom varnished natural.

Trout Spoon Resembles Black Bug

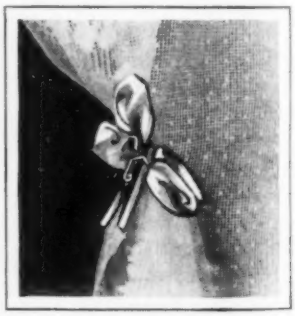
While fishing for trout without success, I found that, while they did not take anything I had to offer, they would strike voraciously at black bugs floating on the surface of the water, so I decided to make some black bugs. The spoon shown in the drawing was made of sheet brass, about .020 in. thick, using a standard trout spoon, about ¾ in. long, for a pattern. After forming the spoon, I dipped it in commercial nitric acid to which as much copper was added as the acid would dissolve, and the spoon was then heated in the flame of a blowtorch until the surface became black. It was assembled with a triple hook, swivel joint and the necessary rings, and given a thorough test which was highly satisfactory. The trout will invariably strike at the black spoon, and as a result I have made many good catches. In making a quantity of these spoons, which I proceeded to do, I ground and polished the end of a 4-in. length of drill rod to the proper curvature, and made an impression with it on a piece of maple. The spoons were cut to the required size, and a ⅛-in. hole was drilled in the narrow end of each, after which they were ready for shaping. This was done by placing them on the maple die and striking the punch a sharp blow with the hammer. After the acid treatment, three dippings sometimes being necessary to obtain the desired black finish, I cleaned and polished the spoons with ordinary floor wax, to protect the finish.—Dick Hutchinson, Ithaca, N. Y.

Unequal Distribution of Load on Auto May Cause Damage

Thoughtless loading of luggage on an automobile easily may cause serious damage to some part of the car. As an example in point, the following experience of one motorist will serve: In order to avoid cluttering up the inside of his car with camping equipment, he mounted an extra trunk and two spare tires behind the regular trunk. Unfortunately, this arrangement was the cause of the rear spring breaking, whereas, if the load had been distributed on the running board, this would not have happened. The extension increased the leverage of the chassis on the rear spring, and it broke.

Butterfly Pin for Holding Curtains

For holding back window curtains, an attractive pin can be made from a spring clothespin and a piece of colored oilcloth, cut and painted to resemble a butterfly. The piece of oilcloth can be bunched between the jaws of the pin, which also hold the curtain as indicated, or it may be tacked on. The clothespin should, of course, also be painted to match the wings.—Jos. C. Coyle, Denver, Colo.



Magnet Attachment on Vacuum Cleaner

By attaching a magnetized bar of tempered steel, ½ in. thick and about 10 or 12 in. long, according to size, to the nozzle of your vacuum cleaner, all particles of iron and steel, such as hairpins, steel pins, tacks, etc., will be picked up. Drill a hole in each end of the bar and screw it to

holes tapped in the front of the nozzle, forming a sort of bumper. In order to prevent marring the furniture with this accessory, fasten a narrow strip of inner tube to the front of the bar.

Asbestos Sheet Speeds Toaster

Toasting a single piece of bread on an electric toaster takes longer than toasting two pieces simultaneously. This is due to the loss of heat from one side and can be prevented by slipping a sheet of asbestos on the unused holder. The sheet may be fitted with a bent-wire handle, so that it can be withdrawn while hot.

Thatched Roof for the Cottage

Exposed framing and a thatched roof make the illustrated cottage picturesque. In the front part, stucco is applied to the panels between the framing, the panels being covered with metal lath, while the walls in the rear are made of untrimmed boards applied to the studs. The interior walls consist of insulating wallboard. The thatching is done by laying bundles of straw on the roof in the same way that shingles are laid, two-thirds of each bundle being overlapped by the lower part of the bundle just above it. The straw is combed down smooth and bound at the top with galvanized-iron wire. Ordinary roofing boards are first laid over the rafters, in the usual way, then heavy tar paper is applied, and after that the straw.

Thatched Roof and Exposed Framing Add to the Attractiveness of This Little Cottage

Large and Small Flower Baskets Made of Concrete and Cobblestones

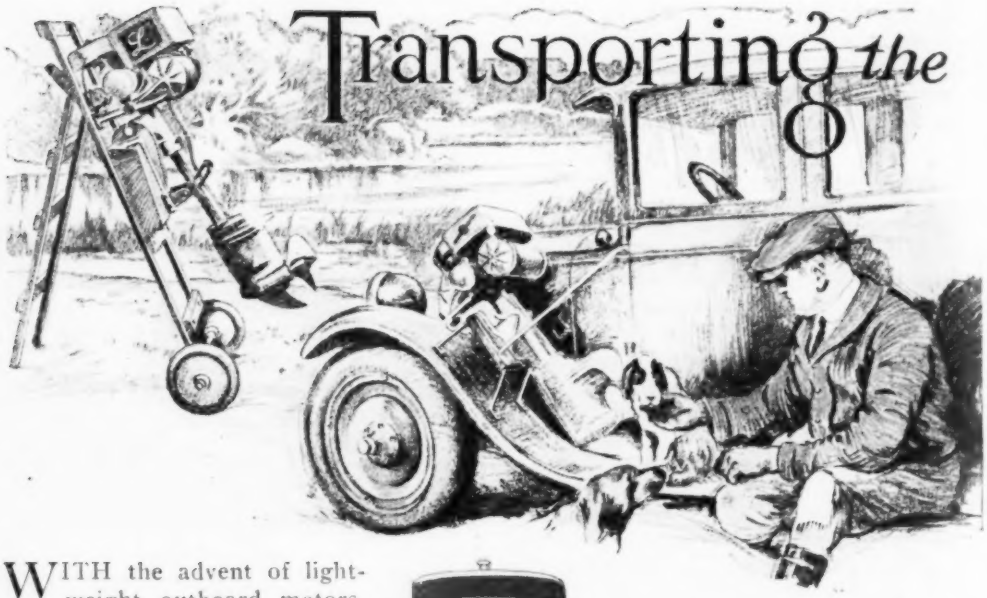
Large Flower Basket Made from Stones

Constructed entirely of concrete and cobblestones, a large flower basket, having a base about 6 ft. in diameter and an arched handle about 5 ft. high, and holding a smaller basket of the same design, makes an attractive garden feature. The walls are about 1 ft. in thickness, and the handle is tapered to a thickness of about 6 in. and a width of 12 in. at the top. A small water pipe, fitted with a spray nozzle, is installed to extend upward through the center of both baskets to water them. This piping is an additional advantage but is not essential. After filling with dirt, ferns and flowers are planted.

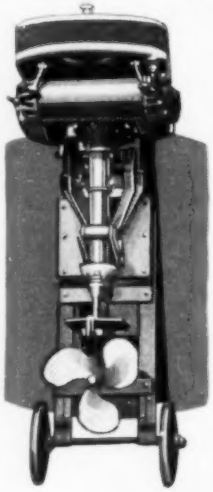
Foiling the Cutworms

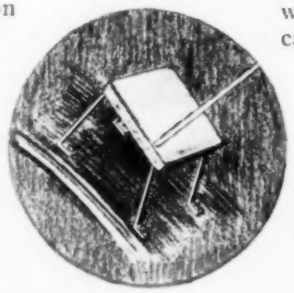
I set about 60 tomato plants, putting a mothball into the bottom of each hole and covering it with about 1 in. of dirt before setting in the plant. The cutworms did not bother my tomatoes, while much damage was done to my neighbor's.—Mrs. R. F. Starzl, LeMars, Iowa.

Transporting the Outboard



WITH the advent of lightweight outboard motors, the use of these power plants for fishing and pleasure trips took on a new aspect. The motor was neat and highly efficient, and among its many excellent features was the great reduction in weight from previous models—thirty-seven pounds as against a hundred plus—and for the same horsepower. This was a godsend for those who packed their motors into "the sticks," but even this thirty-seven-pound load, with its sharp corners and angles, was nothing to be despised when there were two or three miles of trail between you and the boat.





Above, Sketch of the Wheeled Carrier for the Outboard; Right, the Motor in Place on the Car; Center, Close-Up of Motor in Place on Carrier; Below, Detail of Fender Bracket

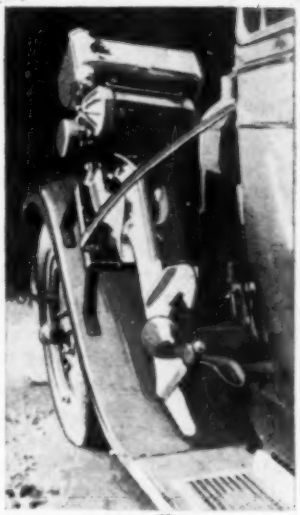
When I was stationed in Panama, the boat I used for tarpon fishing on the Chagres was kept at a landing about two miles from Gatun locks, where the car was parked. Since nothing could be left in the boat with the expectation of finding it upon my return, the motor had to be packed back and forth each trip. With salt-water fittings and an extra 5-in. length of shaft, the motor weighed about 53 lb. This, with 2 or 4 gal. of gas, rods and reels, a ½-gal. vacuum bottle, a 7-ft. gaff, camera, rifle or revolver, and raincoat, was no mean load, especially when you added a tropical downpour, mud, a road consisting of the rotten ties of an abandoned railroad and a catch of fish. I made such trips as these, on an average, three times a week for three years—and I always carried the motor.

For a few trips, I tried detaching the driveshaft and transporting the motor in two pieces, which was much better than carrying it as a unit. For several reasons, this method was abandoned, however, and finally I hit upon the Indian pack-board scheme illustrated. This is merely a ½-in. pine board, 12 in. wide and 30 in. long, tapered at the lower end. Two wedge-shaped blocks were screwed on at the sides, as shown, with a piece of 1½-in. board screwed across them on which to fasten

Outboard

by Capt. F.F.Chamberlin, U.S.A

Above, Left, the Wheeled Carrier on the Dock, and, Right, the Pack Board in Use; Sketch at Bottom Shows Pack Board, and Wheeled Carrier Folded for Stowage



the motor in the same manner as it is fastened to the transom of the boat. The shoulder straps are two ordinary army web belts, with sliding pieces of leather riveted to the board. A little experimenting was necessary to determine the proper angle at which to cut the blocks, so as to keep the motor as close to the board as possible and at the same time allow the screws to be tightened securely. A strap from the lower part of the board around the waist helped steady the board on the back. Packing through mud, however, made this rather dangerous in case of a fall, and it was discarded.

I used this rig on trips without number in Panama, and, since returning to the States, it has been an important part of many expeditions. It will pack in any box that will hold the motor. On a number of occasions, I have used it on the running board of the car, holding it in place with two C-clamps. Unscrewed from the running board, the arms stuck through the straps, it was ready to go.

Back home again, with the excellent results of the pack board to guide me, I purchased a pair of strap hinges, a pair of disk wheels, an axle and a handful of stove bolts, ripped up an old oak table leaf and made a lightweight conveyor that fits into the family auto and makes transportation a pleasure. As may be seen from the illustrations, this conveyor is practically the pack board, lightened and with the addition of the wheels and a hinged section that will make the contraption stand by itself. When not actually used for transporting the motor, it serves as a rack for storing the motor in the summer cottage or in the cellar at home.

I next turned to the problem of carrying the motor on the auto. A number of things are against carrying the motor on the floor in the rear of a sedan, even

though it will fit there, and even if the back seat is unoccupied. I tried several

ideas and at last found one that suited the needs of the case exactly. A pair of simple brackets was made of ¼ by 1¼-in. steel and bolted to the left front fender with a stove bolt through each leg. Across the top of these was bolted the board to which the motor was clamped. To add rigidity, and at the same time protection in case the wingnuts on the motor worked loose, a piece of the same-size steel was run from the top of the rear bracket and bolted just in front of the middle hinge of the door.

In this position, the motor does not interfere with visibility, collects no dust (particularly when a cover is used), is easy to put on and off and offers no resistance to air circulation as do brackets suspended in front of the radiator. It is on a part of the car that is of little value for luggage transportation, and, even on a small car like my own, the location offers ample room for the large racing motors as well as for the standard type for which this bracket was used.

This arrangement has given complete satisfaction. Even when traveling over the roughest roads, where everything in the car is badly shaken up, the motor is not disturbed in the least.

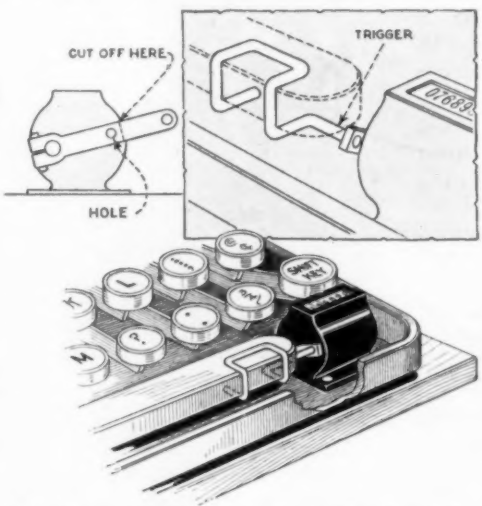
If some disciple of Nimrod or of Izaak Walton desires to take a motor into country where the pack horse is the only means of entry, a few modifications of the straps on the back pack will enable him to carry a light twin either on top or on the side of the pack saddle, with the assurance that it will arrive at its destination right side up and in good order.

Baiting Rat Traps

Finding that the bait in his rat traps was nibbled away by mice, the caretaker of a shop wrapped the bait in a small piece of wire mesh, clinching the mesh securely to the pan on the trip. This prevented the mice from removing the bait, and the rats were caught.

Word Counter for the Typewriter

Any typist who has gone to the trouble of counting the words in a manuscript by averaging the words per line or by any other tedious methods will appreciate the automatic counter shown in the drawing. It consists of a unit counter fitted with a lever and is mounted on a wooden base together with the typewriter. Place the counter next to the space bar as indicated, arranging a wire clip on the latter to trip the lever of the counter. It may be necessary to cut off part of the lever

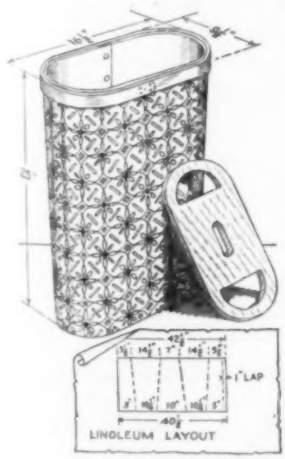


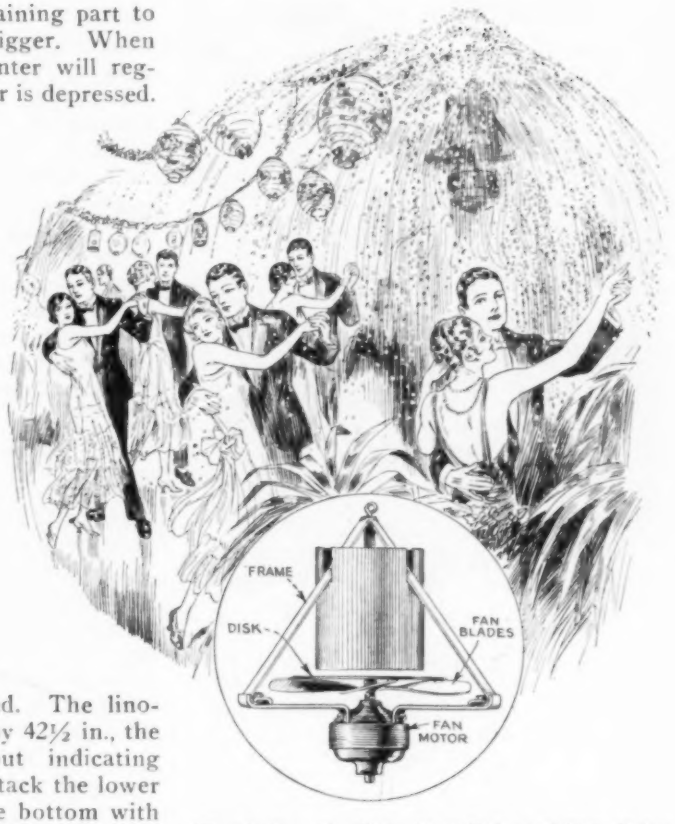
Unit Counter Attached to Typewriter Space Bar Registers Words Typed

and drill a hole in the remaining part to take the end of the wire trigger. When correctly adjusted, the counter will register every time the space bar is depressed. In use, the added space between sentences on a type page will be found to be counterbalanced by the fact that the typist does not press the space bar at the end of lines. —Warren F. Robinson, Jamaica, N. Y.

Homemade Clothes Hamper

Utilizing a spare piece of linoleum, the clothes hamper shown in the drawing is easy to make. The bottom is 6½ in. wide and 16½ in. long with the ends rounded to form an oval, while the top measures 9½ by 16½ in. and is similarly rounded. The linoleum measures 25 by 40½ by 42½ in., the dotted lines in the layout indicating where it is rounded. First tack the lower edge of the linoleum to the bottom with roofing nails. The overlapping edges are fastened together with rivets. A barrel hoop can be bent to the proper shape to fit over the outside of the linoleum at the top, using steam to make the wood pliable when bending. The linoleum is tacked to the rim with large-head brads. Last of all, a cover is cut from ½-in. material, to fit inside the top of the hamper. Two small cleats hold the cover from dropping inside. If desired, the cover may be hinged to the rim.—C. A. Upson, Hammond, Ind.





Electric Fan, Provided with Cylinder and Disk, Makes Good Confetti Fountain

Confetti Fountain for the Ballroom

Throwing confetti in every direction, the fountain shown in the drawing was found highly efficient. A frame was made, which, when suspended from the ceiling, held a 12-in. electric fan in an inverted position. An 8-in. metal disk was soldered to the surface of the fan blades as indicated, and a 6-in. cylinder was attached to the frame directly over the disk but separated from it by a ¼-in. space. With the fan at rest, the confetti was placed in the cylinder, dropping, of course, on the disk. As soon as the fan revolved the confetti was forced over the edge of the disk where it was caught in the draft of the fan and spread throughout the entire room. The cylinder is completely filled before the dance.

¶It is false economy to purchase cheap inner tubes, as they will quickly put an expensive casing on the scrap pile.

Flannel Bags for Dusting

Flannel Bags Fitted with Snap Fasteners Are Handy as Gloves and Dust-Mop Covers

Outing-flannel bags provided with snap fasteners will be found much better for dusting than gloves, as the bags allow more freedom of the fingers. Besides, they launder more easily than gloves and do not shrink. Similarly, it will be found that these bags are handy for use as dust-mop covers, being superior to cloth covers, as the latter must be pinned on, which is a waste of time.

Motorcycle Engine for Boat

It is often asked if a motorcycle engine can be used in a small boat, and the answer usually is that such an installation is not satisfactory, because of the difficulty of keeping the engine cool. An English boating enthusiast who had encountered this difficulty, tried to overcome it by fitting a fan, geared up to a high speed, but this was not satisfactory. The problem was solved, however, in the following manner: He detached the cylinder and wound ¼-in. copper gasoline tubing around it in the grooves formed by the fins. The tubing was wound on in a coil, a piece being chipped out of each fin so that the tubing could be led from one groove to the next. One end of the pipe was led to a small pump, driven from the engine, and the other end through the side of the boat above the water level. The intake to the pump was, of course, taken from the boat's side below the waterline. No overheating occurred in a four-hour trial run on full throttle. The cooling water flows from bottom to top of the cylinder.

Setting Color in Fabrics

Federal clothing experts, who have made tests in the use of various methods of setting the color in fabrics, say that the many home formulas for this purpose are practically worthless. If it were possible to set the color of fabrics by such easy methods as are often advocated, such as dipping in salt water or an alum solution, it would be reasonable to suppose that manufacturers would use such a process before putting their goods on sale, and the fact that they do not, bears weight as to their ineffectiveness.

Broiling Fish over Campfire

In the absence of a wire broiler the camper can readily improvise one from two 3-ft. sticks, about 2 in. in diameter, split at one end to hold the fish as shown in the photo. The fish is cleaned in the usual way, the head and fins being removed, the body split down the middle, but the backbone left intact. Have a flameless bed of hot coals ready and then slip the split ends of the sticks over the fish and hold it over the fire. When nearly cooked, it can be transferred to a frying pan and a little butter or bacon fat and other seasoning added.—M. E. Cowen, Cresson, Pa.

Two Split Sticks Can Be Used for Broiling Fish over the Campfire

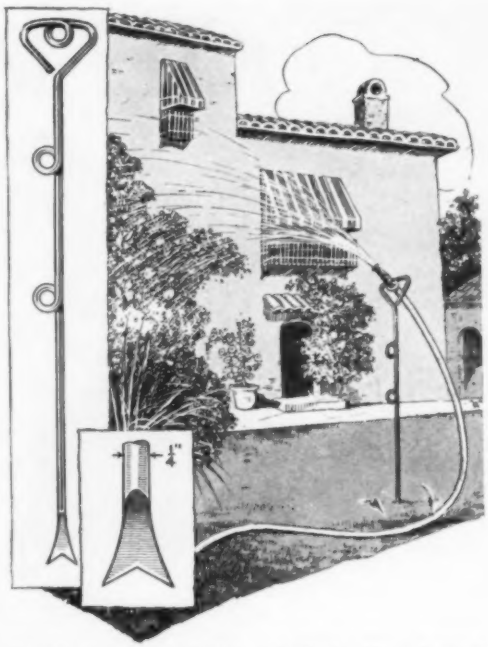
Insecticide for Plants

Bacterial diseases of plants are now being controlled by spraying them with a new insecticide developed by the department of agriculture. The spray has been found highly successful to control bacterial spot on peaches, a disease that costs growers thousands of dollars each year. The ingredients of the spray are as follows: zinc sulphate, 4 lb., hydrated lime, 4 lb., and water, 50 gal., all thoroughly mixed. In Indiana and Arkansas, six applications were found sufficient to bring the disease under control.

Easily Made Hat Holders

In order to prevent crushing hats, which frequently occurs when they are hung on hooks in the closet or laid on a shelf, the illustrated hat rack will be found convenient. Drill a hole in a block of wood as a base to receive the end of a piece of broom handle. Part of a cylindrical paper carton is tacked to the top of this piece and over this is provided a cushion of cotton batting covered with a piece of cloth, which is held in place with a rubber band or piece of ribbon, preferably the latter.—Mrs. C. D. Haddaway, Coral Ridge, Ky.

Simple Hat Holder Which Anyone Can Make Prevents Crushing Hats



Combination Weed Cutter and Garden-Hose Support Made from Iron Rod

Combination Weed Cutter and Support for Garden Hose

The illustrated device serves the double purpose of weed cutter and hose support. It consists of a 4-ft. length of ¼-in. iron rod bent to the shape shown. Three small eyes at various heights are made to hold the hoze nozzle, and a small handle is formed at the top to hold the tool when it is used as a weed cutter. The lower end is flattened and ground to a sharp V-edge, which is forked as indicated in the detail.—Dale R. Van Horn, Lincoln, Nebraska.

Sandpaper Holds Head on Hammer

After experiencing trouble with hammer heads coming off the handles, workmen in a mid-west shop have stopped it by the use of a piece of sandpaper. The paper is wrapped around the end of the handle before it is inserted into the eye of the head, after which the latter is driven home. The friction thus provided is sufficient to keep the head on. The same idea can be used to advantage for holding together furniture joints that have come apart and are to be reglued.—Horace Lemaster, Maryville, Mo.

SCOOTER PROVIDES

Fig. 1. Fastening the Handle and Its Supporting Brackets to the "Deck"; Handles May Be Nailed to Brackets, but Brackets Are Screwed to Plank

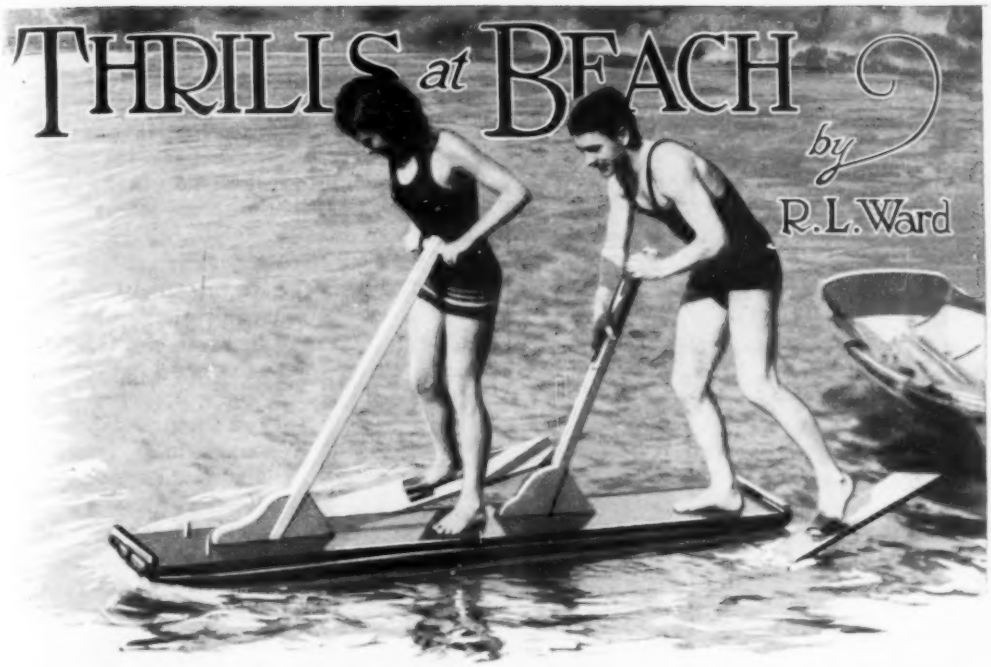
GET ready! Get set! Go! And away go the water scooters. And do they zip? And when you hook them up behind that peppy outboard, it's more sport than a circus! If you're looking for real summer sport, build this water scooter. And not only in the finished job, but in the mere fitting and assembling of this craft, you will find real enjoyment.

We start with a piece of redwood, or any other light, easily worked wood, 7 ft. 3 in. long, 13 in. wide, and 1¼ in. thick. We make this mere plank look like something-in-the-making by nailing into position, about 18 in. from one end, the two wood blocks and the long stem, which compose the handle for our potential water scooter. This operation is shown in the photo, Fig. 1. Now we will use the keyhole saw or bandsaw in fashioning, from ⅞-in. wood, the piece shown in Fig. 2, and in the drawing, Fig. 4. This is nailed along the underside of the plank, as shown. In case you haven't guessed it, this piece is the centerboard. It makes for greater stability in the finished craft and eliminates side drift. Since the nails alone will not hold it rigidly in place, it should be braced here and there with short angle irons, as pictured in Fig. 2.

Fig. 2. In Addition to Screwing the Centerboard to the Deck, It Is Strengthened by Angle Brackets

Forgetting all about woodworking for the time being, we turn our attention to a little business in rubber. This has to do with three inner tubes. Almost any size will do. One of these tubes must be in pretty good shape, patched perhaps but capable of holding air. The other two tubes need not be so good. These two are to be cut in two anyhow, and a tube which has gone "bang" in one place is as good as a new one.

Visit your local junk dealer. If you can, persuade him into giving you all-over good tubes; then cut these two tubes in two, 14 in. from the valve as shown in Fig. 3. Since the cut tubes are to be slipped along the underside of your craft, as in Fig. 3, it is necessary to drill two holes in the forepart of the scooter, as in Fig. 5, so that the valve stems will



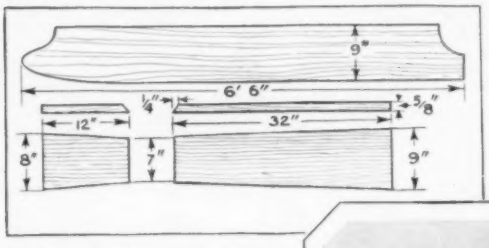
slip up through the wood base of the boat. Naturally enough, these holes may be somewhere else, to fit the tube if you find it necessary or advisable to cut the rubber at some other place than that specified. And, of course, the cut ends of the tubes must be vulcanized before you nail them into position. In nailing the sealed ends of the tubes to the wood, you must be careful to keep the nails well outside the air-holding portion; also the nails must not be driven directly into the rubber, but rather into a short crosspiece first, then into the rubber, and finally into the plank, as shown in Fig. 3. The uncut tube is slipped around the centerboard, as in Fig. 7, with the valve facing to the rear. These three tubes, together with the wood parts, will float the average person with the deck of the scooter barely awash; if you weigh over 150 lb., snap another inner tube or two around the centerboard.

Even though the tubes have been fairly well stretched in the nailing process, they will still sag to some degree. To eliminate this, it is necessary to wire them close under the plank, using heavy wire, or, better, a wide web of canvas, as shown in Fig. 8. As can be seen from the photo-

Fig. 3, Left, Nailing the Vulcanized End to the Plank; Below, Stretching Tube to Opposite End

graph, the wire (or canvas) does not run completely around the centerboard, but through holes drilled well up under the deck of the scooter.

This completes the actual scooter. The paddle to make it go is something else

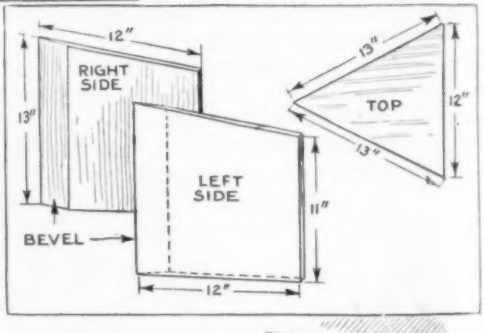


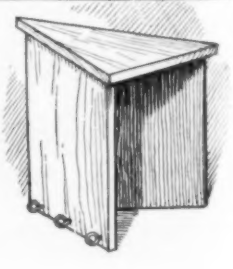
again. This calls for two pieces of 5/8-in. wood, of the size and shape shown in the lower sketch, Fig. 4. These two pieces are fastened together with two small strap hinges, after the manner shown in Fig. 9. Numerous forms of binding to strap the paddle to the foot are practical. A plain web of heavy canvas does very nicely. The average ski binding is excellent. A very simple shoe binding, and one that is better than either of the foregoing types, is made from an old shoe, with the heel removed and the rear part of the upper cut away. Nailed into position 3 in. from the joint in the paddle, as shown in Fig. 10, it makes a very secure binding for the foot, yet it does not hold so tightly but what it can be kicked loose immediately after the inevitable ducking. The shoe should be well waxed in order to keep it from hardening by the continuous wetting. The scooter, and the paddle, too, should receive a few coats of paint or varnish.

In learning to use the water scooter, the very first thing you should, must, and will do consists in getting all wet. Like the canoe, the ski and the skate, this thing of wood and rubber has its limitations. But let's up and at it! The paddle on your right foot, your left foot on the scooter, your hands on the handle—shove off! Immediately after shoving off, bring the paddle foot forward. If the hinges are working nicely, the forepart of the paddle stick will flap backward, as in Fig. 10, and then, when you shove your foot back in the propelling stroke, the hinged portion will snap out, scoop up the water, and, altogether, offer such resistance that you will naturally scoot forward.

But watch the return for the second stroke. You will find that the sudden lifting of the paddle from the water and the consequent bobbing, weaving motion of the scooter is very upsetting. That is, at first. After you have learned when and when not to rely on the paddle for balance—oh, my! Six miles an hour? Easy! Eight miles an hour. Yes, sir! Ten miles an hour? You can go like a racehorse if your legs are racehorse legs.

Of course, the water scooter is not really a "scooter." It doesn't pretend to be as fast as all that. Neverthe-

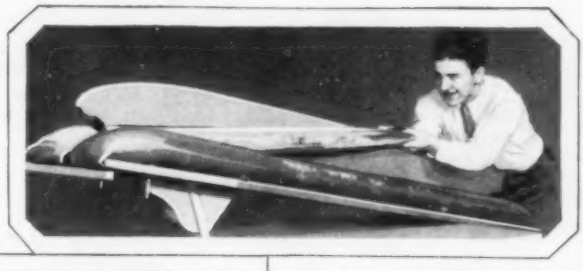


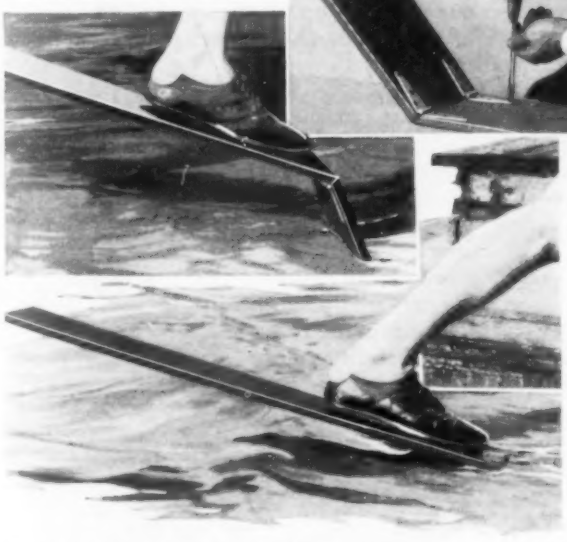


Figs. 4, 5 and 6, Dimensions of Centerboard and Paddle; Seat for "Surfboard Scooter," and, Center, Boring Holes for Tube Valves

less, with the tandem rig shown in the headpiece, an amazing speed can be attained, as well as other surprising maneuvers, until the partners learn to co-ordinate their efforts.

If you want real speed, however, try aquaplaning with the water scooter. There's sport for you! Even behind a rowboat, this thing of getting a free tow has its particular appeal. In using the scooter as described as a surfboard, several minor additions are necessary. In the first place, you will need two paddles, one for either foot. These need not be of the "web" type described; a single flat length of wood will do the business. In the second place, you will need a place to sit on. Rather modernistic it is, too. Fig. 6 gives you the shape and dimensions of the three pieces which compose the seat, and the three pieces assembled. In order to make the seat portable, it is not fastened permanently to the main body of the scooter, but merely held by means of two long pieces of wire running through interlocking screweyes fitted into place along the two lower edges of the seat and the top of the plank. With such a simple device, it is a matter of a minute to change the mere scooter into a real scooter.





Figs. 7, 8, 9 and 10. Stretching Third Tube over Centerboard; Support for Tube; Hinging the Paddle Flap, and the Paddle in Action on Forward and Back Strokes

And it's dead easy! Doing the scooting, I mean. Despite all and sundry stories you may have heard about the knack of aquaplaning, you will find the scooter in this form a perfectly stable little craft. Oh, of course, you can make it exciting enough. Try lifting both paddles out of the water when going 25 per. Try sailing without the paddles. Try getting off the seat entirely. Try doing three back somersaults and a layout from off the handlebars. Oh, yes you will! You'll do better tricks than that—and never know about it till you hit the water!

The tandem water scooter shown in the headpiece is built in the same manner as the single craft, except that it is longer and requires more tubes to support the pilots. Note, too, that the partners use the paddles on opposite feet. Both paddles should move forward and back at the same time and with the same stroke. Of course, they won't at first, which will lead to some unexpected and disconcerting maneuvers of the scooter.

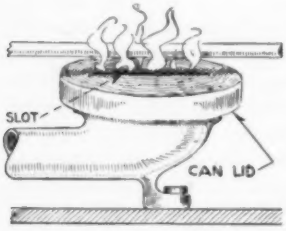
Improvised Sawdust Blower for the Jigsaw Made from Powder Bellows

Blower for the Small Jigsaw

When using a jigsaw, the outline on the work constantly becomes hidden by sawdust and the worker usually has to blow the dust away. An automatic blower can be improvised from a small insect-powder bellows placed on a block located in such a position that the lower part of the saw frame will strike it, as shown in the drawing. A length of rubber tubing, slipped over the spout and tied to the jigsaw, directs the puffs of air against the point where the sawdust collects and thus keeps the work clean.

"Idling" a Camp Stove

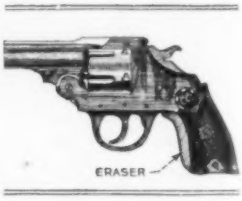
Often a camper wishes to keep the gasoline stove lighted during short intervals between actual use, rather than to relight it. However, the flame must be kept burning rather high to keep the generator sufficiently hot. If the flame is too low, a slight breeze will readily extinguish it, with the result that the generator cools off and the stove becomes flooded with gasoline. To avoid this trouble, get a tin-can lid to fit rather freely over the burner, and cut a long, narrow slot across it, as shown in the drawing, the slot being placed directly under the generator tube, thereby directing all the flame against it. A stiff wire wrapped about the lid will facilitate handling it.—D. Rockwell, Hollywood, Calif.



Gas Oven Makes Running-Board Icebox

For keeping salads and other edibles cold when out on a picnic or camping trip, an ordinary gas-plate oven having an upper and lower compartment will be found highly convenient. A wooden box, large enough to hold the oven and allow a 1-in. space between the two, is fastened to the running board. Screws and wingnuts can be used for this purpose, the screws passing through both box and running board and the wingnuts being turned on from underneath. Lock washers should be used to prevent the wingnuts from getting loose. The oven is then set in the box and the intervening space is filled with wet newspapers, which make excellent insulation. Newspapers are also laid on the top of the oven, and the top of the box is then attached with nails or screws.

Rubber Grip for Revolver Butt



Many small revolvers have such a small butt that they tend to twist sideways when the trigger is pulled. To increase the size of the handle and at the same time provide a better grip, attach a piece of rubber, such as an eraser, as shown in the drawing. Ordinary friction tape is then wound around both handle and rubber to hold the latter in place.

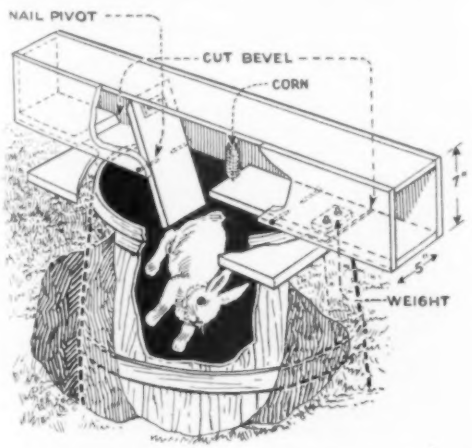
Good Brushes Required to Produce Smooth Undercoat for Enamel

Many amateur craftsmen will be surprised to learn that enamel does not cover brush marks. In order to avoid them, it is necessary to have a perfectly smooth undercoat and this is not possible with cheap, coarse brushes having stiff bristles.

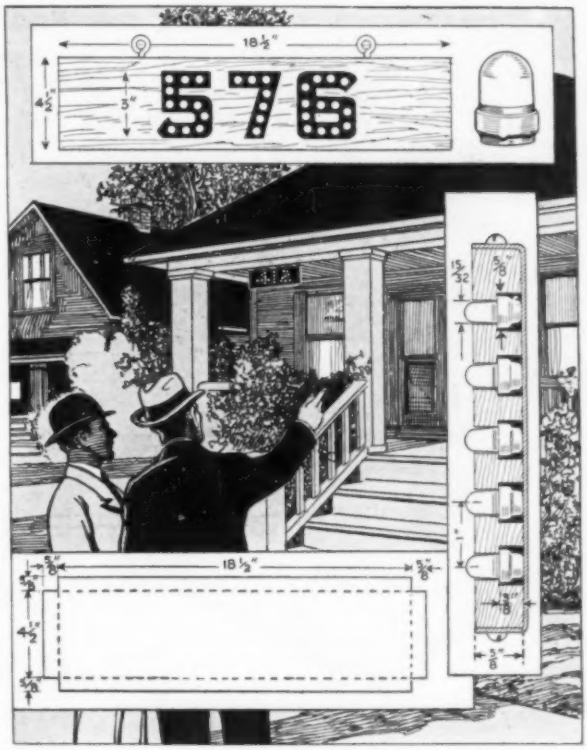
A good badger-hair brush may be more expensive, but is well worth the extra cost when one considers the superior grade of work made possible by its use, as the undercoat for enamel can be laid on so smoothly that very few if any brush marks will be evident and very little sanding is necessary.—L. H. Georger, Buffalo, New York.

Pitfall for Rabbits

One of the most effective traps I have ever used for rabbits is shown in the drawing. It consists of a runway made of 1-in. boards, which is set over the open top of a barrel sunk into the ground. The bottom of the runway is sawed into four sections, of which the two in the center are pivoted. Note that the outer ends of the pivoted parts are beveled so that they will trip when the rabbit reaches the bait, which consists of an ear of corn attached to the inner end of one section. Small pieces of flat iron, screwed to the underside of the pivoted sections, hold them horizontally, and cause them to return to this position after they have dropped a rabbit into the barrel. The open top of the barrel not covered by the trap is closed with a few boards, and a pile of brush is thrown over the whole.—E. E. Beach, Horton, Kans.



This Rabbit Trap Is Easy to Make and Has Been Found Very Effective

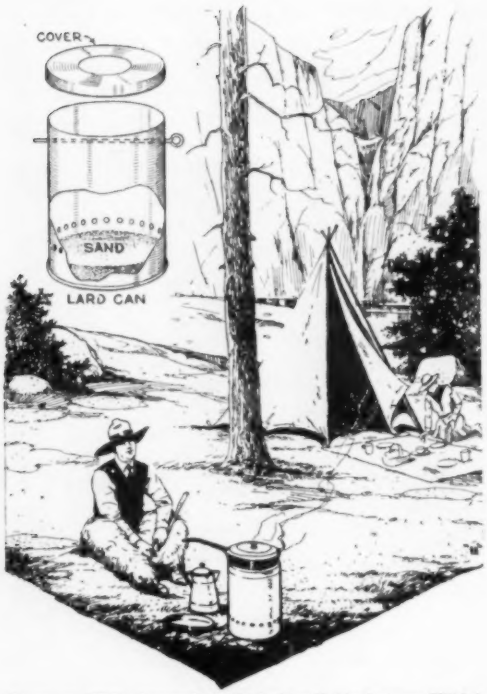


Small Colored Reflectors Make House Numbers Visible at Night

Reflectors Used for House Numbers

After noting the results obtained on highway warning signs and advertisements, I installed "rayflectors" of the type shown in the drawing, for house numbers. The smallest size of reflectors obtainable was used, mounted on a 18½ by 4½-in. board. A piece of sheet metal was cut and bent at points indicated by the dotted lines of the lower detail, and was then attached to the back of the sign to hold the reflectors in place, the latter being inserted in counterbored holes shown in the right-hand detail. The number board was fitted with two screweyes so that it could be suspended in a position where it would swing freely in the wind, which caused it to reflect more light and be more easily noticed. The drawing gives all dimensions covering the installation of the smallest size of reflectors, which can be had in white, green, red and amber.—H. B. O'Connell, West Haven, Conn.

¶Occasionally oil the hinged joints of an umbrella to prevent them from rusting.



Campers Will Appreciate This Small Cookstove Which Uses Gasoline-Saturated Sand as Fuel

Gasoline-Saturated Sand Makes Good Camp Fire

One tourist found that a lard can, perforated with a row of holes about 5 in. above the bottom, as shown in the illustration, and then filled with a 4-in. layer of sand saturated with a quart of gasoline, was highly superior to the usual improvised camp stove. The advantages are elimination of smoke and soot, and production of a steady heat, which any cook will readily appreciate. It was found that a quart of gasoline, well mixed with the sand, was sufficient to enable three families to cook a meal over the blaze. After the fire dies down a little, the sand should be stirred to renew the blaze. To allow a kettle to hang just above the fire, two holes were punched opposite each other a short distance from the top of the can to receive a metal rod. A hole, 4 or 5 in. in diameter, was cut in the lid, for frying. — Clementine Paddleford, New York, N. Y.

¶ Beeswax makes a better lubricant for dead centers than the usual white lead, oil or grease.

Rubber Handle for Outboard Starter Rope

Anyone who has had the experience of having the starting-rope handle slip out of oily hands when cranking an outboard motor, or has had the rope stick in the flywheel when the motor started, and received a whipping about the arms with the hardwood handle, will appreciate a non-slip handle of rubber. It can be made from a 2½-in. length of ribbed gas hose with an outside diameter of approximately ⅝ in. Drill or burn a hole, the exact size of the rope, through one side of the hose at the center. Then thread the rope through the hole and bring it out of the end. Slip a small washer over the rope and tie a knot. This handle is not likely to slip as quickly as a wooden one and will not hurt so much in case of a whipping.—Herbert M. Allemeier, Maumee, Ohio.

Holder for Dipping Baby Bottle in Hot Water

Sterilizing the baby's bottle in boiling water is greatly facilitated by the use of the holder shown in the drawing. Ordinary galvanized-iron wire, obtainable at any hardware store, is used for making it. The eye at one end forms a spring which forces the jaws apart. In use, the jaws are forced over the bottle and are then pressed together with the fingers. Held in this way, the bottle can be dipped in boiling water without burning one's hands. —Fred T. Pindar, Valdosta, Ga.

Simple Holder for Baby Bottle Facilitates Sterilizing It in Boiling Water

A SAFE AND SANE NOISE MAKER FOR THE FOURTH

By GORDON SPROULE

INDEPENDENCE Day again looms on the horizon, and it might be well to ask ourselves well in advance: What is going to be the result of the annual check-up on fingers and eyes after the big day is over? Last year Bob nearly lost an eye. In fact, the danger to life, limb and property is so real that in our town, for example, the sale of fireworks is absolutely prohibited.

Bob's close shave suggested that something more should be done—it is not feasible to prohibit the sale of fireworks in neighboring towns—and we thereupon constructed a "banger" that has proved eminently satisfactory. The boys like it, it makes a big noise, and it is safe—no matches, no smoldering remains, no fire hazard, no flying pieces, no danger to fingers or eyes.

The drawing shows the present model, which could probably be improved, possibly making it lighter. Any mechanic can make one or more for his boys, who will be the envy of their chums, while mother can retire to an inner room knowing that each crash means the boys are all right. The banger consists of an anvil and ram, each made of 1-in. tool steel, permanently connected by a ⅛ by 1-in. flat iron, U-shaped frame. The legs of the frame are fastened to the anvil with 3/16-in. rivets, as shown. The ram slides within the "U," and is prevented from falling out sidewise by means of side guides, welded on. A wooden handle, 34 in. long, works through a hole in the top of the frame, and is driven into a hole drilled into the top of the ram. After driving the handle home, a hole is drilled through both ram and handle and a pin driven through it. In the center of the anvil top a hole is drilled with a size-A drill (.234 in.) to a depth of 3/16 in. This hole is drilled, of course, before the banger is assembled, and holds a capsule filled with a detonating mixture. The banger is lifted vertically a foot or so and struck smartly on the pavement, on a stone, or even on the sod. The percussion explodes the mixture in the capsule with a loud report, about equal to a good-sized "salute," but sharper.

The capsules are made as follows: Get from the druggist 200 empty gelatine capsules, Parke Davis No. 2; these are regularly 35 cents per hundred. Also get 3 oz. pulverized potassium chlorate (not chloride) and 1 oz. pulverized sulphur; these chemicals will cost 25 or 30 cents. They must each be ground to a smooth, flourlike powder, and must be pulverized separately. Mix the two powders by rolling them on a sheet of paper by lifting alternate corners, or by gently shaking them together in a cardboard box. Spill the mixture out on a sheet of paper, and break up lumps if necessary by touching them with the finger. Do not rub these powders together in a mortar or bowl. Attend to this mixing operation yourself. If some of the mixture is ignited with a match, it will fizz and flare, but not "go off" like gunpowder; friction, pressure or impact will detonate it violently.

When the powders are thoroughly mixed, spread out on a paper and load the capsules by dabbing the open end of the long part into the mixture until the shell is full, then put on the cover; the boys themselves will be tickled to do this part of the manufacturing.

A hundred capsules make a small pocketful; fifty make a good barrage. Each boy carries a hook of brass wire to extract the remains of the capsule, if any stays in the anvil.

Waterproof Ticket Holder Made from Old Inner Tube

To keep rain from damaging tickets and bill sheets, left by truck drivers near a temporary and somewhat isolated loading platform, a neat holder was made from part of an old inner tube, as shown. Two small strips of wood were placed opposite each other on the inside of an 8-in. piece of the tube, and tacked to the wall. Another short strip was similarly used to fasten the bottom, forming a pocket. A flap, a trifle wider than the pocket, was cut and nailed several inches above it, which effectively prevented rain from getting inside.

Silencer for Noisy Flush Tank

To silence noisy flush tanks, devices on the market are designed to be placed in the supply pipe to cut down the speed of the water as it enters the tank. The same results can be accomplished in about an hour's time at a negligible expense in the following way: Get a No. 18 flat-head wood screw, 4 in. long, and a length of wire solder. The latter is wrapped around the screw spirally, allowing ¼-in. space between each turn and winding it in the direction opposite to the threads. The screw and spiral are then driven into the supply pipe, leaving a short piece of the screw projecting out of the end of the pipe, after which the screw head is cut off. Of course, the pipe is removed in order to do this. When the pipe is replaced, the water will be sufficiently retarded to stop the noise.—Ernest Romkee, Colorado Springs, Colo.

Tube Helps Empty Bottles Quickly

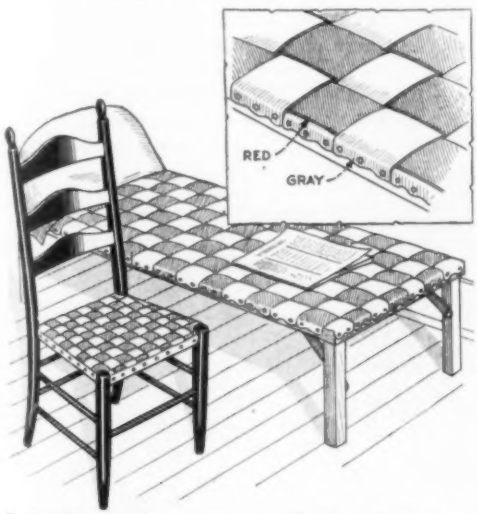
Narrow-necked bottles cannot be emptied rapidly because air cannot enter quickly to replace the outflowing liquid. However, by inserting a piece of tubing, bent as shown, into the bottle, the bend making it possible to wedge the tube in place, air is given access to the bottom of the bottle as soon as this is turned over, and the liquid flows out without gulping.—Harry Moore, Montreal, Can.

Marking Rows in Garden

Onions, carrots, parsnips and a few other garden vegetables have so little foliage at the beginning that weeds almost hide the rows from view, and it becomes difficult to cultivate such plants without danger of hoeing them out or covering them up, especially if a wheel hoe is used. To overcome this trouble, one farmer mixed a small quantity of lettuce seed with the onion seed, cabbage seed with the carrot seed and radish seed with the parsnip seed. The leafage of these added greens is always conspicuous, and as they grow fast they make good row markers for the slower-growing plants.—H. H. Siegele, Emporia, Kans.

Old Inner Tubes Make Comfortable Chair Seats and Bunks

Old inner tubes make good chair seats and will also be found satisfactory as substitutes for springs in a cot or bunk. Cut the tubes into 2-in. strips of the proper length and fasten the ends to the chair or bunk frame with large-head upholsterers' tacks, weaving the strips as shown. The best method of doing this is to tack down all the strips running in one direction first, then weave in the cross strips, and tack them all down. By using red and gray rubber, pleasing effects can be obtained. —Russell Alexander, Washington, Ind.



Basket-Weave Chair Seats and Bunk Springs Made from Discarded Inner Tubes

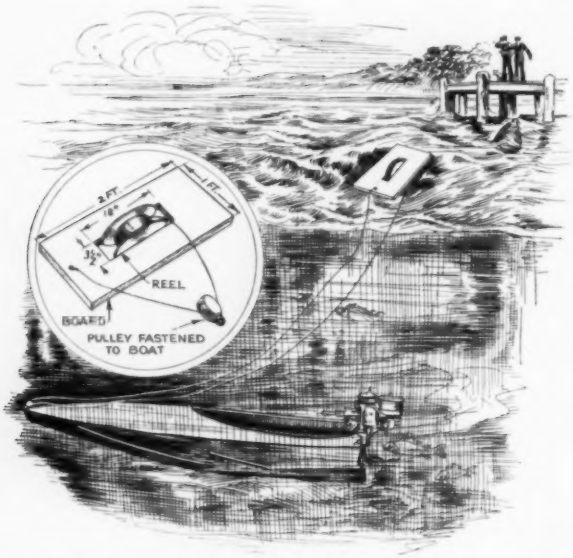
Fruit Jars Containing Minnows and Suspended in the Water Attract the Fish

Effective Fish Decoys

When fishing from the shore the decoys illustrated will often be found effective. Get several fruit jars of large size, punch holes in the tops, and, after filling the jars with water, put in the minnows. Tie a length of heavy cord to the lids and suspend the jars from tree limbs projecting over the water as shown in the illustration, then watch your luck change.—R. D. Rose, Maud, Miss.

Preventing Accumulation of Water in Gas Tank

Water, caused by the condensation of air on the sides of a partly filled auto gas tank, often causes trouble as it settles to the lowest point of the gasoline system and may then obstruct the flow of gasoline in the case of a gravity-feed system, or it may freeze if the temperature is low enough, thereby also shutting off the gasoline supply. This trouble is more likely to occur when the gas tank is kept only partly filled. If you have had any trouble with water in your gasoline system, make it a practice to keep the tank full.—C. Ed Packer, Chicago, Ill.



Boats Equipped with This Float Can Be Readily Located If They Have Sunk

Float Shows Location of Sunken Boat

Every year a great number of small boats equipped with outboard motors capsize and are lost in deep water. Sometimes they are recovered, but more often they cannot be located and are therefore abandoned. The trouble can easily be eliminated by providing a float fitted with a reel, which will rise to the surface and can easily be found by the searching crew. The drawing shows a float, 2 ft. long and 1 ft. wide, with a rectangular hole cut in the center to accommodate the reel on which twice as much line is wound as is necessary for the float to reach the surface from the deepest point in the lake. A pulley is fitted to the boat and the line is passed through it and then tied to the float as indicated. The buoyancy of the float will cause the reel to unwind, and the line will slip through the pulley on the boat as the float rises to the surface. It must be located in such a position that it will not be obstructed in any way, and must be held in a suitable housing, such as a box on the deck, so that it will not fall into the water in ordinary conditions.—Harry A. Leonard, Hollister, Calif.

Simple Method of Tempering Tools

Tempering tools, such as drills, cold chisels, etc., in the regular way is a task that usually requires considerable experience. However, there is an easy method of doing this which can be followed by anyone even though he has never before attempted such work. Just heat the point of the drill or the part of the tool to be tempered to a cherry red, and then force it about ½ in. into a bar of lead. Leave it there for about 30 seconds, then remove and plunge it in cold water. The result will be a hard and tough edge.

Improvised Clothes Closet

Many home owners, who seldom use their attic, will find that the attic stairway can be utilized to advantage by transforming it into a clothes closet as shown. A panel as wide as the stairway, forms the back of the closet. It must, of course, be made removable, which is done by nailing two grooved 2 by 2-in. strips to the walls and sliding the panel between them. A handle is provided on the lower part so that it can be raised when necessary. Strips of ¾-in. stock are screwed to the panel and to the walls to serve as supports for clothes hooks.

A Seldom-Used Attic Stairway Offers a Practical Solution of the Closet Problem

SHOP NOTES

Buffing Head Makes Vertical Sander

By M. CLYDE SMOCK

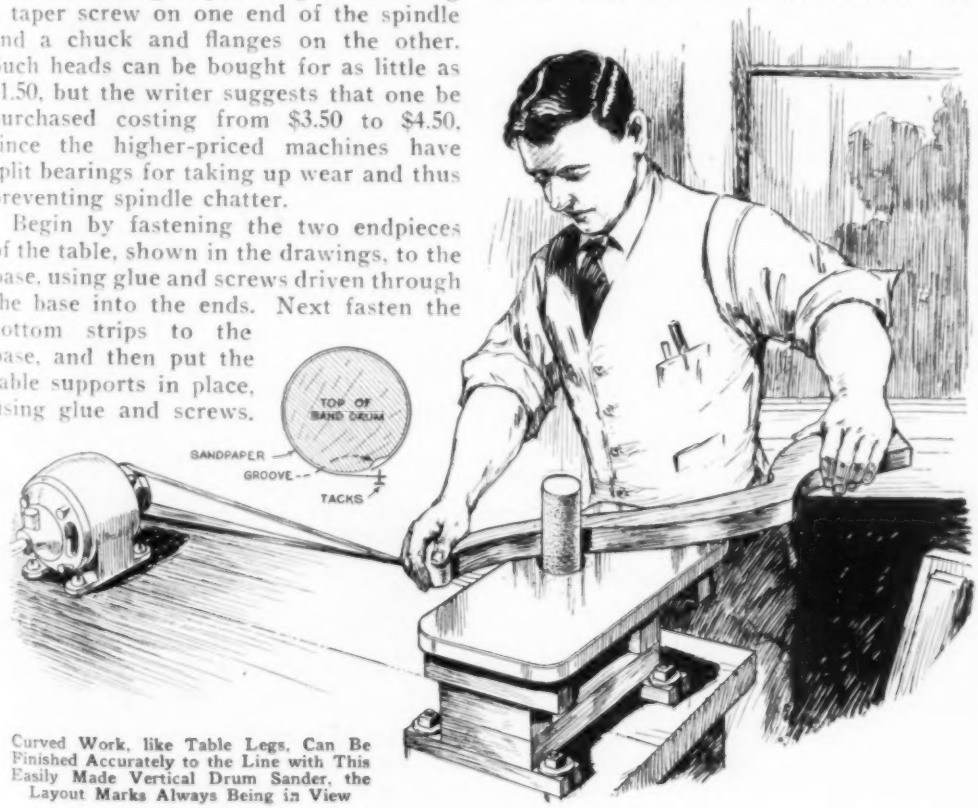
THE LITTLE sander described below is not only cheap and easy to construct, but is an exceedingly useful tool in the small shop. With its drum running vertically and the table in a horizontal position, the sanding of curved pieces, such as table legs, can be done very accurately, since the lines on the work are always in plain sight.

The main element of the machine is an ordinary buffing or polishing head, having a taper screw on one end of the spindle and a chuck and flanges on the other. Such heads can be bought for as little as $1.50, but the writer suggests that one be purchased costing from $3.50 to $4.50, since the higher-priced machines have split bearings for taking up wear and thus preventing spindle chatter.

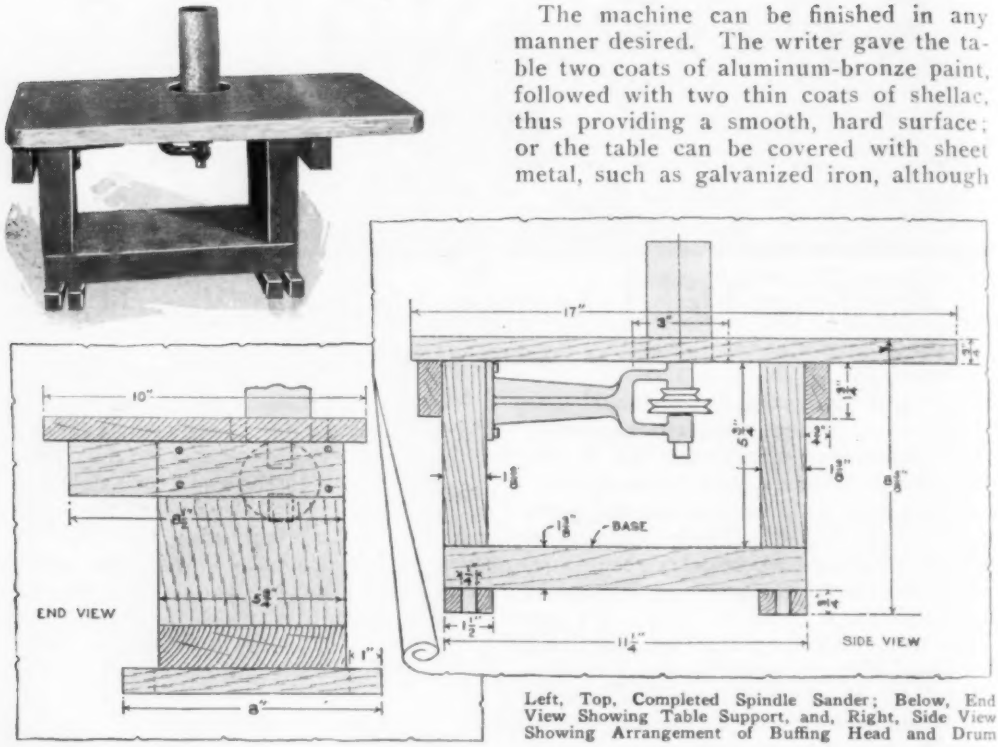
Begin by fastening the two endpieces of the table, shown in the drawings, to the base, using glue and screws driven through the base into the ends. Next fasten the bottom strips to the base, and then put the table supports in place, using glue and screws.

With a hacksaw, cut off the end of the spindle that carries the chuck, allowing ¼ in. to project beyond the bearing, then fasten the head to the endpiece as shown, using long screws. The end of the bearing should be even with the tops of the endpieces, and the spindle should be made exactly vertical, before the screwing down is done.

Cut the table to size and bore or cut a 3-in. hole for the drum, then fasten it with



Curved Work, like Table Legs, Can Be Finished Accurately to the Line with This Easily Made Vertical Drum Sander, the Layout Marks Always Being in View



Left, Top, Completed Spindle Sander; Below, End View Showing Table Support, and, Right, Side View Showing Arrangement of Buffing Head and Drum

flat-head screws, 2 in. long, countersinking the heads into the top, so that they will not interfere with the passage of the work across the table.

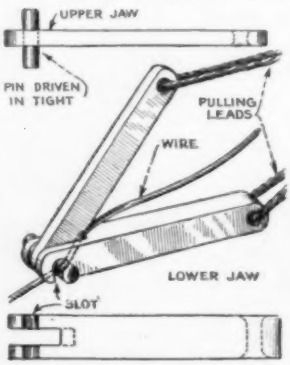
The sand drum is of hardwood, preferably maple, from 1½ to 2½ in. in diameter and 4 in. long. A shallow groove, ⅛ in. deep and ⅜ in. wide, is cut lengthwise of the drum, and the sandpaper is fastened by wrapping it around the drum, with the ends overlapping in the groove, then tacking it in place, with the tacks in the groove. The hole in the end of the drum is very carefully centered and drilled, and the drum screwed on the tapered end of the spindle.

A round or flat belt, depending on the type of pulley used on the head, is run to the motor through the back of the sander. The speed should be from 2,000 to 3,000 r.p.m.

When using the machine, remember to apply a light pressure, and to keep the work moving constantly; otherwise the drum will "eat" into the wood. The spindle should run clockwise when viewed from the top.

The machine can be finished in any manner desired. The writer gave the table two coats of aluminum-bronze paint, followed with two thin coats of shellac, thus providing a smooth, hard surface; or the table can be covered with sheet metal, such as galvanized iron, although this is not essential. Also, the whole frame of the machine may be constructed of angle iron, if the builder prefers this to wood, using 1¼ or 1½-in. angles for the legs and table supports, and 1¼-in. flat iron for braces.

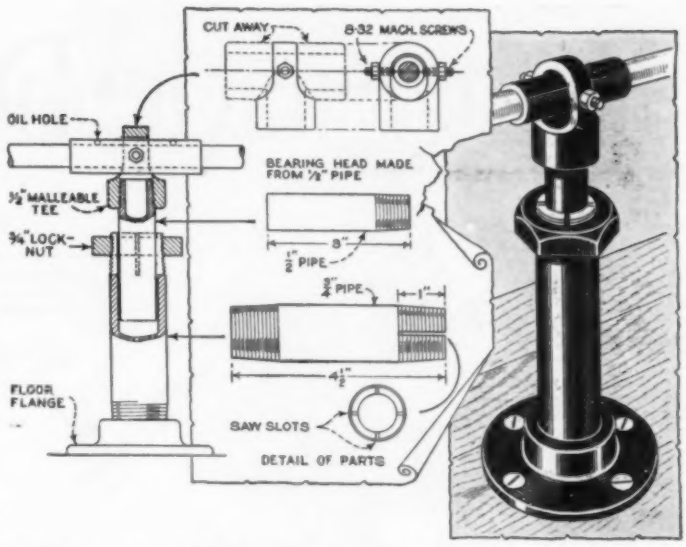
Wire Gripper for Flat Stock



Two pieces of flat bar stock are used to make the wire gripper shown in the drawing. The lower jaw is slotted to receive the end of the upper jaw. Across the forked end two notches are filed to take a pin which is driven tight into the other jaw. Both are drilled to take the pulling leads, and the wire is slipped between the jaws.

Self-Alining Shaft Hangers

Automatic alinement is the feature of the small shaft hanger shown, which was made almost entirely of pipe. The part housing the shaft bearing is a plain malleable-iron tee. The ends of the tee are cut away as indicated, and two holes drilled and tapped diametrically opposite each other to receive the setscrews. The ends of the setscrews are ground to the same angle as that of the drill which is used to make a seat for them in the bearing. A standard bronze bushing of sufficiently small diameter to allow it to move freely in the tee is used. As a substitute for a regular bearing bushing, an automobile spring-shackle bolt bushing has been found satisfactory. A pipe nipple is fitted into the threaded part of the tee and is then slipped into a larger nipple, in which it should make a sliding fit. Four slots are sawed lengthwise in the end of the second nipple so that this end can be compressed tightly on the smaller nipple by means of a suitable locknut, after the shaft hanger is adjusted. A floor flange which fits the lower end of the larger nipple is screwed to the wall, ceiling or other support for the lineshaft. The sizes given in the drawing were followed by the writer, who used spring-shackle bolt bushings for bearings, accommodating a 9/16-in. shaft. Ordinary 8-32 machine screws were used to hold the bushing in the tee, which was of ½-in. size. The smaller nipple also was of ½-in. size, which was found to fit nicely in a ¾-in. nipple.—G. T. Fowler, Bakersfield, California.



This Self-Alining Shaft Hanger Can Be Made from Pipe Fittings with Little Expenditure of Time and Labor

Card File for the Auto

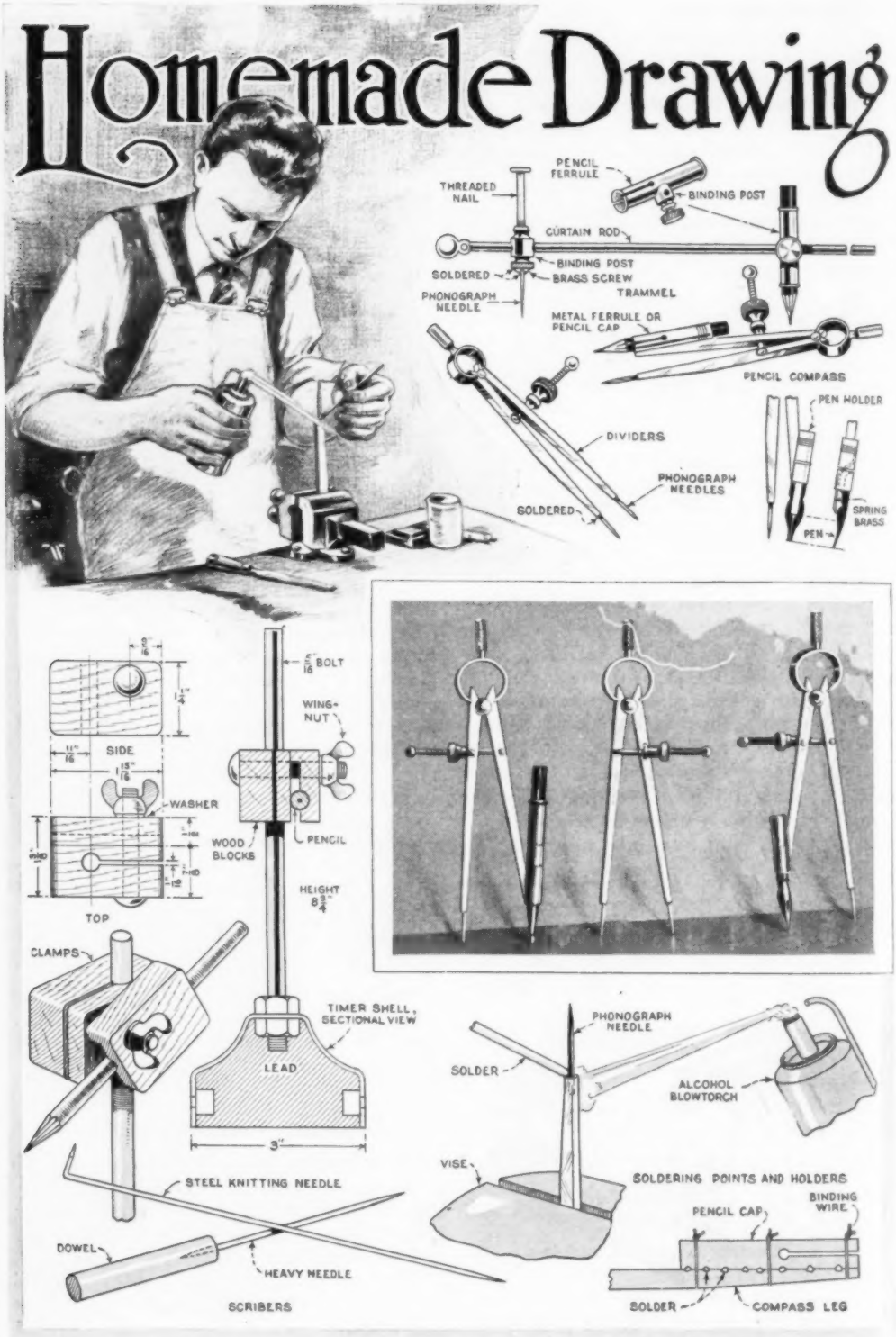
For the salesman, collector or other business man covering a territory in his car, a card file, installed under the instrument board, as shown in the illustration, will prove highly useful. The box containing the drawer is held in place by means of metal brackets and, if desired, the drawer can be padlocked.—M. MacDonald, Brooklyn, N. Y.

Salesmen and Collectors Will Find This Card File a Great Convenience

Preventing Loss of Hotel Keys

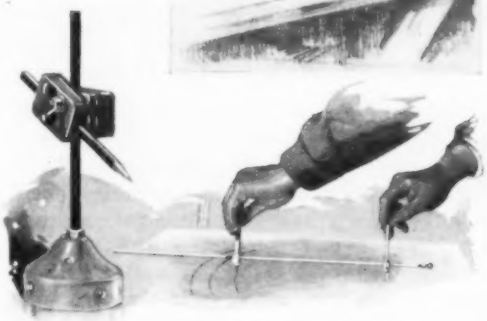
An effective method of reminding patrons to return the room keys when leaving, has been found by a summer-resort-hotel keeper. At the end of the fiber tab to which the key is fastened, a small bell is attached. The little bell tinkles a gentle reminder, which has prevented the loss of many keys.

Homemade Drawing



Instruments

By Edward Thatcher



THE HOMEMADE drawing instruments shown in the accompanying drawings have been in constant use for several years, and, although I have a splendid commercial set of instruments, I seldom use them, as I much prefer the quick and rigid adjustment of the homemade tools. I use them not only on the board, but also on the bench, where I constantly make drawings as I work, or utilize them to lay out the work itself. The surface gauge, while not strictly a drawing instrument, is included because of its usefulness in layout work, for which purpose I prefer it to a very expensive one I own, especially for such work as modeling

The drawings are all self-explanatory, and little need be said about the construction of the instruments. The compasses and dividers are made from common spring dividers as sold in the chain stores for machinists' work. One leg of the dividers is filed down until the surface of the end is large enough to drill a small hole to take a phonograph needle. The needle is soldered in place, using killed acid as a flux, and either a heavy soldering bit or a small blowtorch to heat it. The dividers have a needle soldered in each leg, and the pen and pencil compasses a needle on one leg and a pen or pencil holder on the other. For the pencil, a common brass pencil tube is used, and soldered to the compass leg as shown in one of the sketches. For the pen, the metal end is removed from an ordinary penholder and soldered to the leg of the compasses.

For very large circles, a good trammel bar is made up from a small-diameter curtain rod, a couple of good-sized binding posts, a pencil holder and a phonograph needle, assembled as shown. Two of the trammel points may be made with phonograph needles, one with a pencil holder and one with a penholder, so that the instrument can be used for all varieties of layout work and drawing. To solder the needles in place, screw into the bottom hole of the binding post an 8-32 screw, of such a length that it will not lock on the trammel bar. Force the needle into the slot in the screw head so that it stands upright, and solder firmly in place. The handle for the trammel point is a common wire nail, threaded 8-32 and substituted for the knurled-head screw.

To make the pens hold more ink, simply cut a strip of thin, springy brass and force it into place on the underside of the pen point and up into the holder as shown. Quite a quantity of ink will then be held in the space between brass and pen, and will flow to the point as needed.

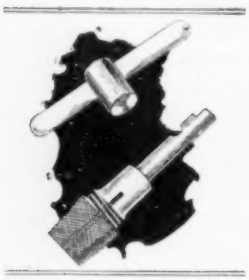
Cheap Sidewalk Made of One-by-Four-Inch Boards for Muddy Patches between Farm Buildings

Board Walk for the Farm

Made of strips of 1 by 4-in. material, nailed together as shown in the illustration, this sidewalk for the farm sheds water as soon as it falls, and has been found highly satisfactory over muddy patches between the house and near-by sheds. The cost also is much less than that of a cement walk, as it can be made from old stock found around the farm. The spaces between the boards should be so narrow that they will not catch even the foot of a child.—Flora Clark Gardner, Tipton, Iowa.

Attachment Makes Drill Chuck of Automatic Screwdriver

Your automatic screwdriver can be made more useful by fitting it with a chuck so that you can use drills from 1/64 to 1/8 in. in diameter. Get a small T-wrench for taps, which is obtainable at any 5 and 10-cent store. Knock out the cross rod and saw off the shank a reasonable distance from the chuck, then turn the shank to the proper diameter to fit the screwdriver. A notch, corresponding to the one on the screwdriver bit, is filed in the shank, after which the attachment is ready for use.—Warren L. Miles, Providence, R. I.

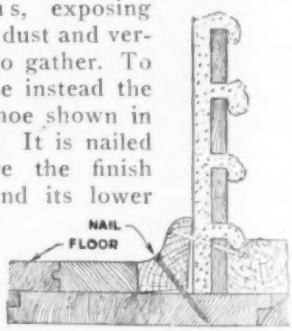


Quick Return for Arbor Press

When pressing a large number of small pieces in a bench arbor press, raising the arbor after each operation means considerable work. A good method of eliminating this is as follows: Drill and tap a hole in the top of the spindle, drop a spring of sufficient strength down over it to raise the arbor spindle, but not strong enough to interfere with the operation of the press. In doing this, use a washer on the end of the spring and insert a cap-screw through the washer, driving it into the tapped hole in the end of the spindle. The screw serves to adjust the tension of the spring besides holding it in place. The operator presses down the spindle, which rises of its own accord as soon as it is released.—Charles R. Whitehouse, Boston, Mass.

Sanitary Base Shoe Is Better Than Baseboard

Usually a baseboard has a piece of quarter-round stock on the edge. This often loosens, exposing cracks in which dust and vermin are likely to gather. To prevent this, use instead the sanitary base shoe shown in the illustration. It is nailed in place before the finish floor is laid, and its lower edge is of the same thickness as the finish floor so that both will fit together flush. When installing the shoe, plane the back side at a slight bevel so that, when the piece is nailed in place, the top edge will fit tightly against the wall. The dotted lines indicate the wrong position of the nail, which should be driven into the shoe at a 45° angle and penetrate into the subfloor.—H. H. Siegele, Emporia, Kans.



THESE MOVING SCARECROWS ARE EFFECTIVE

These Homemade Sheet-Metal Scarecrows, Which Rotate in the Wind, Have Been Found Effective on Farms to Keep Geese Away from Wheat Fields

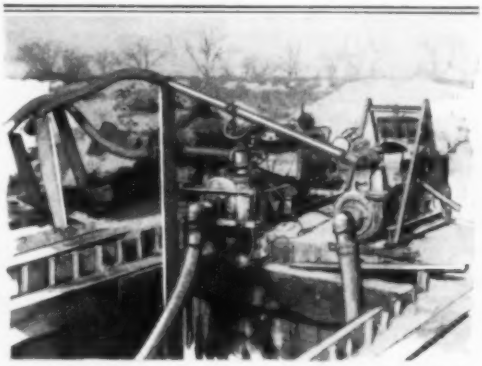
Moving around in the wind like huge weather vanes and thus constantly shifting position, the scarecrows shown in the drawing have been found highly effective, 21 of them being in use on my 700-acre farm. The body portion, resembling a man holding a gun, is cut from sheet metal, and is fastened to a length of ¾-in. pipe bent as indicated. The pipe should extend about 2 ft. below the body and is inserted into a 24-in. length of 1¼-in. pipe, provided with a cap at its lower end and sunk into the earth. These scarecrows have kept geese from taking wheat crops, a task which formerly required the services of several hands.—W. H. Jones, Oroville, Calif.

Annealing Tool Steel Quickly for Machining

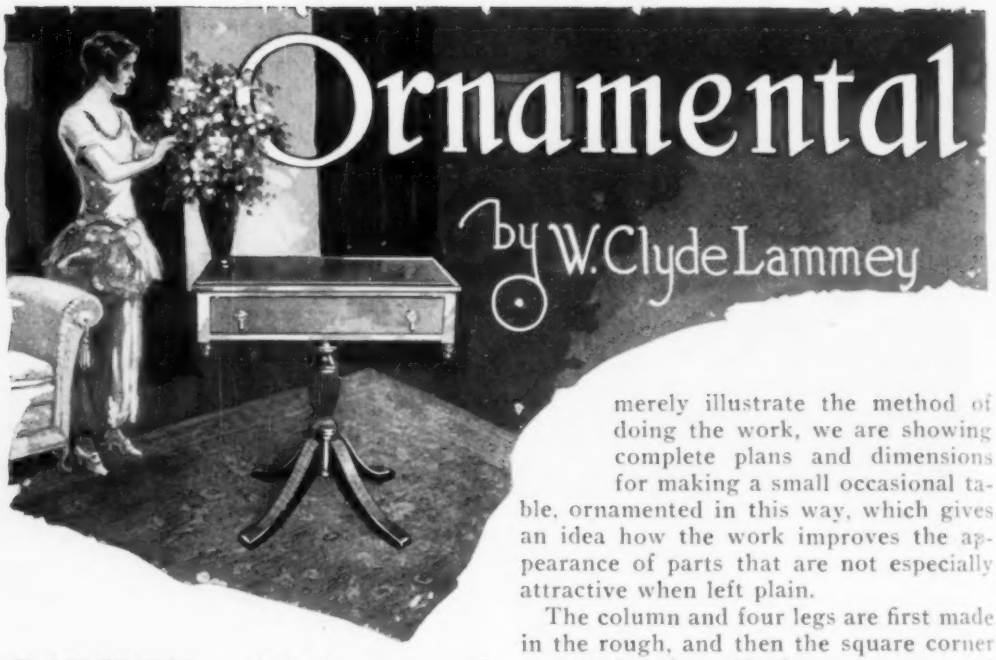
Carbon tool steel can be annealed quickly so that it can be machined, in the following way: Place it in a furnace and gradually run up the temperature to 1,360° F., or if a furnace is not handy, place it in a fire and heat it very slowly until it is a little under a cherry-red, after which it is allowed to cool until it looks black in the light, but is still a dull red when held inside a keg or box. Keep the steel in such a dark place until it is just cooling from a dark red and then quench it in water at 60° F. The steel will be a grayish white and appears to be glass-hard, but it will be soft enough to machine.—H. K. Ellis, Cincinnati, Ohio.

Cheap Power for Centrifugal Pumps

When installing two centrifugal pumps for excavating work in the bed of a stream, the contractor saved several hundred dollars by purchasing two used automobiles having good motors, to drive the pumps, one pump being connected directly to each driveshaft. The car bodies were removed and the ends of the frame cut off with a torch. An A-shaped frame of 3-in. angle iron, welded to the car frame, was used to lift the pump about with a crane.—Jos. C. Coyle, Denver, Colorado.



Centrifugal Pumps Connected Directly to Driveshafts of Old Autos



Ornamental

by W. Clyde Lammey

POSSESSING a distinctive charm of its own, reeded and fluted work is not nearly so exacting as woodcarving, and it can readily be done by the home worker. Reeding and fluting are terms used to denote the corrugations cut in the surface of furniture, which are usually confined to the legs, columns and heavy framework. Reeds, often called beads, are convex in form, while flutes are concave, and are sunk into the surface. Both can also be combined in alternate reeds and flutes. In the accompanying drawings examples of both are shown, the column of the table being both reeded and fluted, while the corner newels of the top are fluted only on one side. The tools needed are merely a few curved chisels or gouges of various sizes. Rather than merely illustrate the method of doing the work, we are showing complete plans and dimensions for making a small occasional table, ornamented in this way, which gives an idea how the work improves the appearance of parts that are not especially attractive when left plain.

The column and four legs are first made in the rough, and then the square corner newels for the table frame are cut and their finials turned. Red gumwood, $^{13}/_{16}$-in. stock, is used for the base, fancy walnut plywood is obtained for the top and sides, while the remainder of the hidden work may be birch. For the column, rip five pieces from $^{13}/_{16}$-in. gumwood, each piece 20 in. long and 4 in. wide. Glue the five pieces together, face to face, making a block as shown in the upper right-hand section of the drawing on page 167, and clamp solidly to dry. For the four legs, rip eight pieces from the same stock, 4½ in. wide and 12 in. long. Glue these together in pairs to make the 1⅝-in. thickness required. Be particular, when clamping the stock, to draw the parts tightly together in order to get a good joint. For the corner newels, get a piece of solid wal-

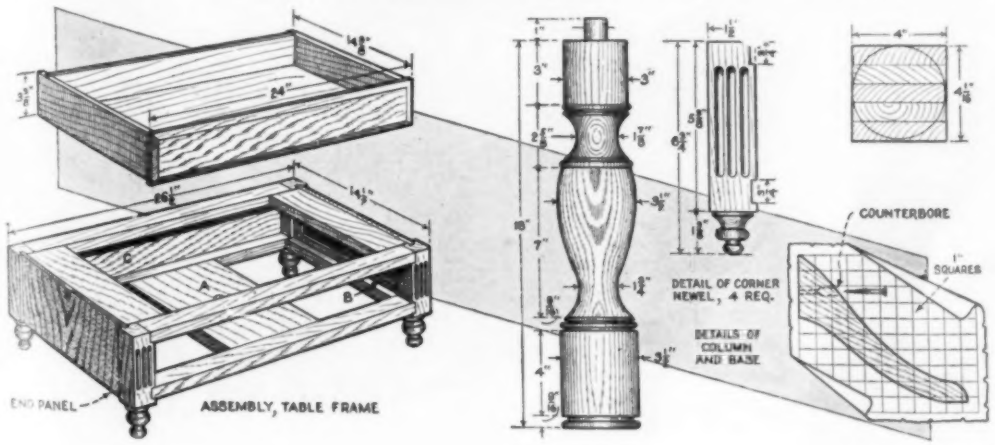
Laying Off Guide Lines on the Curved Surface of the Table Column

Reeding and Fluting

nut, 1½ in. square and 30 in. long. Plane smooth, square the ends and then cut this into four 7-in. lengths. Set up each piece in the lathe and strike lines across the four faces and 1⅜ in. from one end. Turn to approximately the shape shown in the same drawing, but be sure to get the four pieces exactly alike. Sand the work smooth while in the lathe. Cut the rabbet and housing as indicated, ¾ in. wide and ¼ in. deep, on all four pieces. Run a ⅜ by ¼-in. groove close to the edge on the back face of the front newels and on the front face of the back newels. These grooves take the end panels. Stop the grooves at the turning, so that they will not deface the finished work.

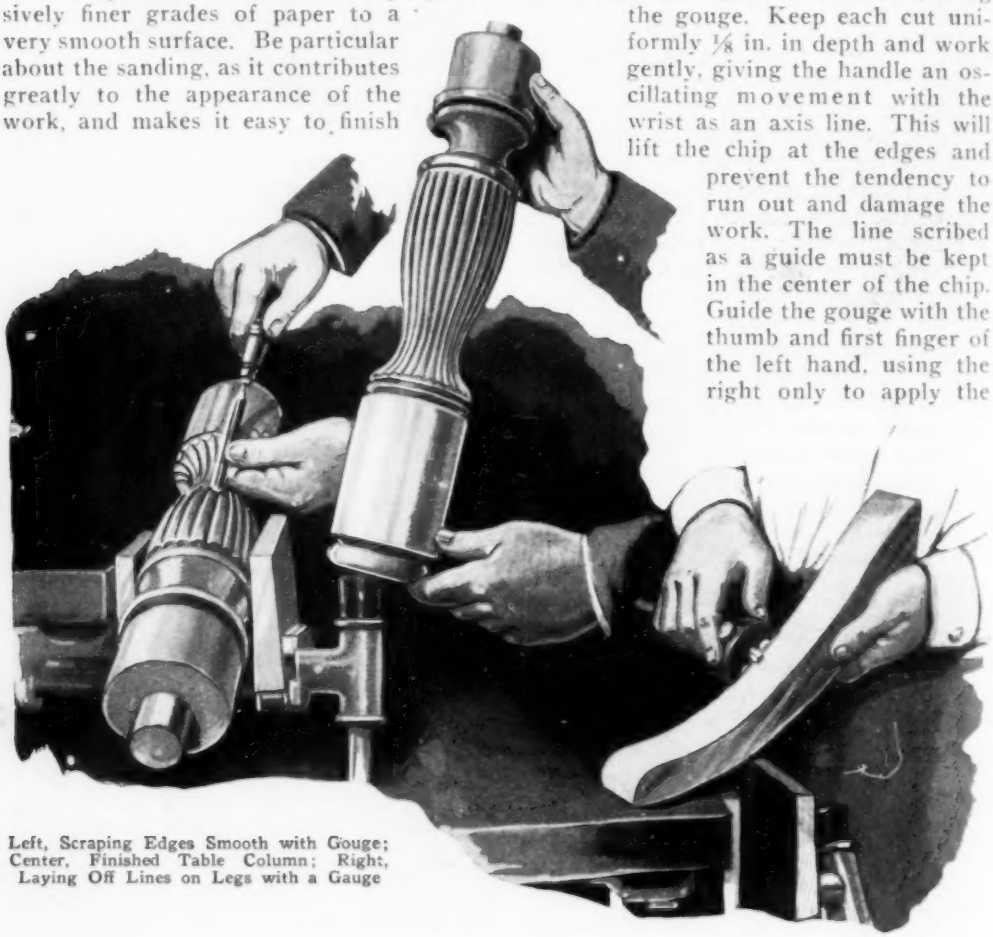
After the stock for the legs has dried for 24 hours or more, remove the clamps. Make a full-size layout on cardboard, using 1-in. squares as indicated in the lower right-hand detail. Trim the cardboard template to the proper shape. Then carefully saw one end of each piece to an angle of 30°, after which the form of the leg is laid out on the wood. Saw to the line with a scrollsaw, if a band or jigsaw is not available. Then sand the sawed edges smooth.

The column provides an interesting job in turning. Most small lathes used in home workshops have motor headstocks, that is, the motor is directly connected to the work so that no variation in speed of the live center is possible. For this reason, it is necessary to have the work carefully balanced so that it will drive at the



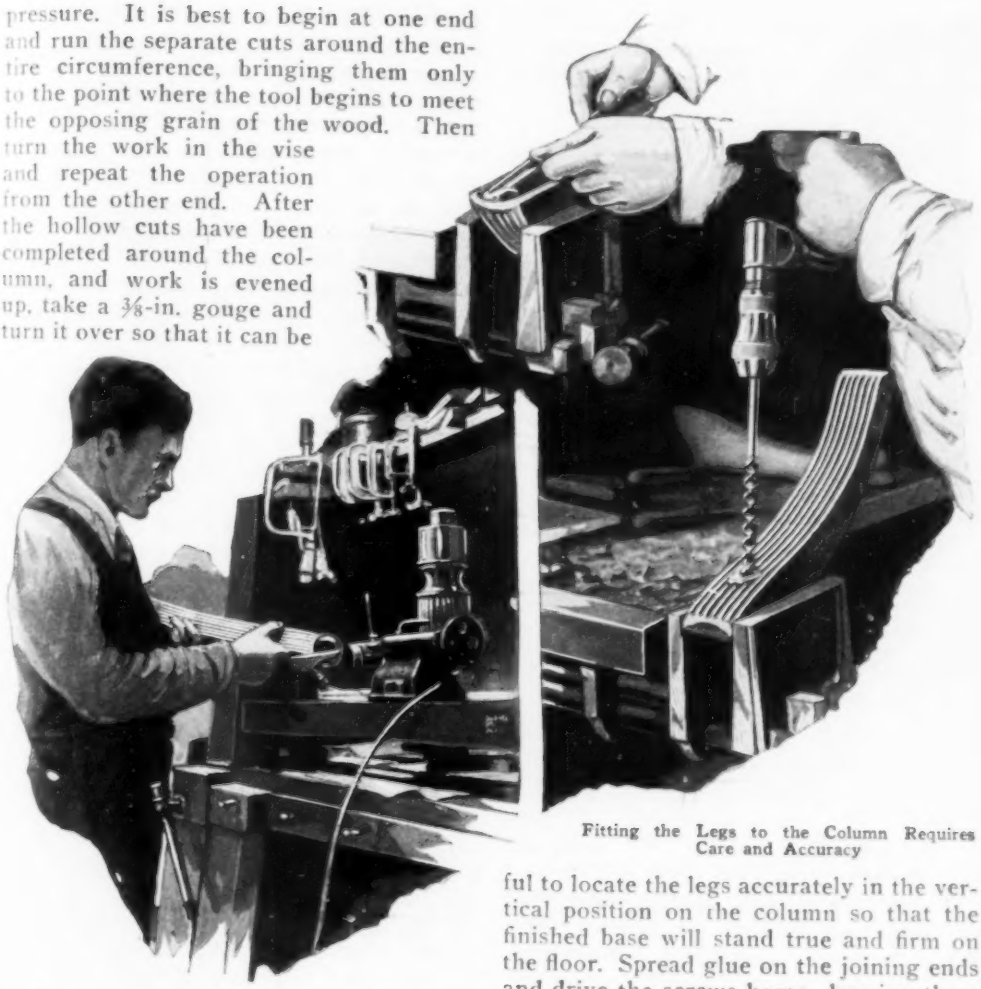
high speed without excessive vibration. Locate the center by diagonals, drawn on the ends from corner to corner. Set your dividers to a radius of 2 in. and scribe a circle on each end of the work. Plane off the four corners with a jointer plane or, if a circular saw is handy, tilt the table 45° and saw off the corners. The result will be an octagon-shaped piece whose sides are tangent to the circles scribed at the ends. If cut in this way, the piece usually will be well balanced, but if not, plane off the faces until it is. Do not permit any vibration of the work, as this is not only dangerous but is apt to do considerable damage to the motor bearings within a few minutes. First turn the piece to a cylinder of a uniform diameter of 3½ in. Lay out the separate sections as indicated in the drawing. Turn to the desired shape and then sand with progressively finer grades of paper to a very smooth surface. Be particular about the sanding, as it contributes greatly to the appearance of the work, and makes it easy to finish properly. Before removing the work from the lathe, set the dividers to about ¼ in. and step off the divisions of the reeds around the smallest diameter of the section to be reeded and fluted. Should the divisions step unevenly, change the adjustment of the dividers slightly until they come out accurately. On a diameter of 1¾ in., you can lay off exactly 22 divisions of ¼ in. each. Mark each division with a pencil. Set a marking gauge against the toolrest, adjust the arm until the point is directly over the axis of the work and then mark each division, sliding the gauge against the toolrest while holding the work from turning. Score the wood heavily so that the marks can be easily seen.

After the column has been marked, it is locked in a horizontal position in the vise, and the cuts are started at one end, using the gouge. Keep each cut uniformly ⅛ in. in depth and work gently, giving the handle an oscillating movement with the wrist as an axis line. This will lift the chip at the edges and prevent the tendency to run out and damage the work. The line scribed as a guide must be kept in the center of the chip. Guide the gouge with the thumb and first finger of the left hand, using the right only to apply the



Left, Scraping Edges Smooth with Gouge; Center, Finished Table Column; Right, Laying Off Lines on Legs with a Gauge

pressure. It is best to begin at one end and run the separate cuts around the entire circumference, bringing them only to the point where the tool begins to meet the opposing grain of the wood. Then turn the work in the vise and repeat the operation from the other end. After the hollow cuts have been completed around the column, and work is evened up, take a ⅜-in. gouge and turn it over so that it can be used as a scraper to round off the sharp edges of the reeding.

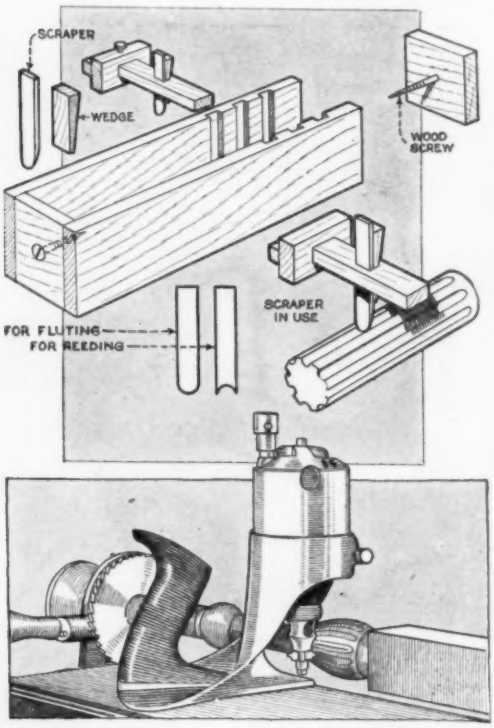


Fitting the Legs to the Column Requires Care and Accuracy

The fluting of the legs is done practically the same way. As the width of the leg is 1⅝ in., six guide lines are made. When finished, counterbore the legs first with a ½-in. and then with a ¼-in. bit at the point indicated, to accommodate a single heavy screw. The ends of the legs that join the column must be cut concave to an accurate fit. Use a wide gouge and pare the ends to a depth of about ⅛ in. Then use a sanding drum of the proper diameter in the lathe, as shown in one of the photos. Sand to a perfect fit on the column. Locate four equidistant points about the circumference at the lower end of the column and drill small holes to take the screws to hold the legs. Be careful to locate the legs accurately in the vertical position on the column so that the finished base will stand true and firm on the floor. Spread glue on the joining ends and drive the screws home, drawing them up very tight so that the joint will fit snugly. Fill the holes up level with the top of the reeds with plastic wood, which can be later cut down to conform to the surface.

Run the fluting on the two front newels. The two front drawer rails are cut from 13/16-in. solid walnut to exactly 24¼ in. in length and 1½ in. in width, and are then planed to ¾ in. in thickness. A groove, ¼ in. wide and ½ in. deep, is cut in the center of the back edge of each rail. The back rails, of birch, are made to exactly the same dimensions. Assemble the front and back rails to the newels first, using glue on the joining ends, glue-sizing the ends first before the final coating is put on and the work clamped. Cut the back panel from ¼-in. plywood and

slide it into the grooves when assembling. When dry, fit the runner and the centerpiece in place, using glue at all the joints



Jig for Reeding Work of a Uniform Diameter, and Motor-Driven Tool for All Kinds of Work

and clamping it tight, making sure that the parts are correctly positioned. Cut the end panels from ⅜-in. walnut plywood so that the grain will be vertical. Do not glue the end panels, but trim them to a light fit and leave loose. The drawer front is made of 13/16-in. walnut plywood, ripped to 4 in. in width, and cut to 24 in. in length. Rabbets, ½ by ½ in., are run on the back edges and across the ends. For the inner construction, ¼-in. stock is used, the drawer sides being simply nailed to the shoulder of the rabbet across each end of the front. The usual grooves are cut for ¼-in. plywood for the bottom, and the whole is then glued together in the regular way. Round over the edges of the drawer front with a block plane and sand very smooth. Try the drawer for fit in the frame and set the guides.

The top is cut from 13/16-in. walnut plywood to the dimensions indicated. If a molded edge is desired, take the top to a cabinet shop where this can be done. Bore a 1-in. hole at the centerpiece of the table frame to take the dowel turned on the end of the column, spread glue underneath and, after noting that the frame is correctly positioned, lock the parts securely with four screws, equally spaced and driven into the end of the column. Lay the top on a flat surface, upside down, invert the frame over it and screw the parts together. Stain all gumwood parts with a walnut oil stain, wiping the reeding lightly to obtain an antique finish. Fill all the walnut with walnut paste filler. Allow it to dry thoroughly and then sand the wood smooth with 6-0 wet-or-dry paper and linseed oil. The oil brings out the beauty of the walnut and at the same time prevents the fine paper from clogging. After all parts have been sanded, clean up with turpentine and give them two coats of high-grade flat varnish. When dry, rub all the flat surfaces with 8-0 wet-or-dry paper and linseed oil. Then rub down with powdered rottenstone and oil, having the cloth soaked with the oil and the rubbing stone being sprinkled lightly over the surface. Continue the rubbing until a soft satin finish is obtained. Last of all, apply two bronze pendant drawer pulls to the front of the drawer.

The last drawing shows two other methods of reeding and fluting. The box in the upper detail is used for straight pieces having a uniform thickness throughout. The work is held securely by means of wood screws driven through both ends, as indicated. One end is adjustable to suit the length of the work. A device resembling a marking gauge in general construction and method of use, is provided with a fluting or reeding tool. These are virtually scrapers, made from old hacksaw blades, ground down to the required shape and sharpened to a keen edge.

The tool is placed in a square hole and tightened by means of a wedge. In the lower detail a small motor-driven tool is shown, which can be used for reeding and fluting curved pieces as well as those of uniform diameter. While the work is held rigid in a lathe or index centers, the tool is moved along the surface as indicated.

Washing Painted Walls

Anyone who has tried to wash the dirt from painted walls and ceilings knows how difficult it is to get a clean job without streaks and smears. Here is a method that results in as good a job as can be desired without the objectionable features just mentioned. Make up a hot solution of concentrated washing powder, using enough of the latter to make the mixture assume a jellylike consistency when it has cooled. This paste will not run and splash around. Apply it to the surface of the wall with a calcimine brush and use the same brush to rub the surface, which will quickly loosen the dirt. Then take a sponge, immerse it in clean water and wring it out thoroughly, after which it is used to absorb the paste and dirt on the wall. It has been found that a stiff-bristle brush is not satisfactory for loosening the dirt, and cloth cannot be used to advantage as a substitute for a sponge. —Frederick J. Pease, Wauwatosa, Wis.

Canvas Bag Aids Ice Delivery

To avoid dripping water on the floors of homes, a western ice company provides its men with waterproof canvas bags, as shown in the photo. The men also carry towels to wipe up drippings around the icebox when the ice is transferred from the bag to the ice compartment.—H. A. Konderman, Oakland, Calif.

Homemade Fly Paper

Fly paper can be made at home at a cost of about 1 cent for a dozen large sheets. All that is needed is 2 lb. of rosin and 1 pt. of castor oil. Heat these ingredients together until the mixture looks like molasses. Then take an old paintbrush and smear it on sheets of paper, doing this while the mixture is hot.—E. G. Moore, Washington, D. C.

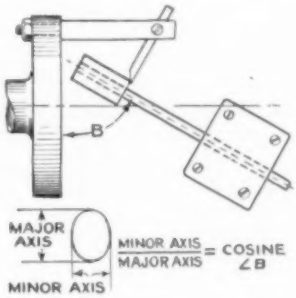
An Electric Outlet on the Workbench Will Save the Worker Considerable Time

Handy Outlet for the Workshop Bench

When using a small drill or other electric tool in the workshop, it is usually necessary to remove a lamp, which is unhandy and involves quite a waste of time. It is much better to provide an extra outlet on the bench.—A. Mathieu, Chicago.

Turning Cams on a Lathe

Turning cams on a lathe was successfully done by the method shown in the drawing. Make a bearing in the compound rest to hold the shaft or arbor. Use two pieces of cold-rolled steel with a key in one piece to fit the tool slot on the compound rest. After clamping the pieces together, a hole is drilled through them to fit the arbor. The depth of the cut can be regulated by tapping the cutter. The compound rest is set to angle B and fed in and out at that angle. The tool is set in a tool holder that is clamped to the faceplate. Quick and accurate work can be done by this method, provided the work is set up properly.



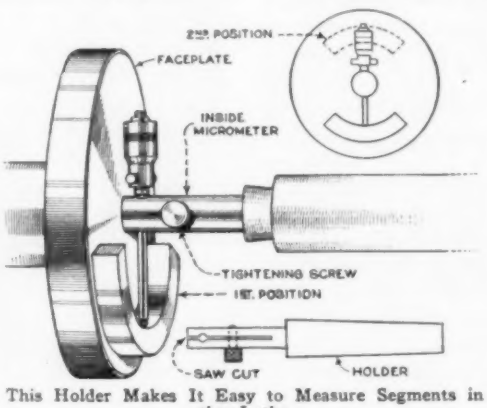
Seeder Attached to Old Auto Fitted with Iron Wheels Covers 165 Acres a Day

Seeding Large Area with Old Auto

Equipping his old flivver with iron wheels and installing a grain seeder on the back, a San Joaquin valley farmer is able to sow 165 acres of barley a day. He keeps a straight course across the field by driving directly toward conspicuous targets placed at each end of the field, the position of the targets being changed every time he reaches them. The tracks made on the ground also help him to keep a straight course.

Flywheel for Hand Emery Grinder

It is well known that the efficiency of machinery operating under a fluctuating load can be greatly increased by providing a flywheel, and this also applies to a hand-driven emery wheel. A neat flywheel can be made by melting a quantity of lead in a round tin-can cover, the diameter of which should be about 1 in. less than the emery wheel's and its thickness ½ or ⅝ in. After the lead has hardened and cooled, the cover is removed and a hole drilled in the exact center, the same size as the emery-wheel shaft. The disk is then slipped on the shaft after the nut and washer on one side of the wheel have been taken off. The nut is replaced but the washer will probably have to be left off, owing to lack of space. After tightening the nut, the emery wheel is revolved and the edge of the lead disk dressed off with a sharp chisel to balance it.



This Holder Makes It Easy to Measure Segments in the Lathe

Battery Compound as Insulation

While doing some insulating work one day on a radio set, I attempted to make use of the sealing compound found on the top of old dry cells and B-batteries. However, after melting this material, it cooled too quickly and, if reheated, became brittle and worthless. After some experimenting I found that by stirring a little kerosene into the melted material it could be worked at about half of the heat previously required. Furthermore, the kerosene did not prevent the mixture from hardening properly.—Charles R. Powers, Owen, Wis.

Measuring Segments in the Lathe

Like many other mechanics I had considerable difficulty in measuring the diameters of half bearings, segments and other pieces in a lathe. However, I solved the problem by using a holder for the inside micrometer, as shown in the drawing. The holder was made to fit the tailstock spindle, and a hole was drilled near the end to take the spindle of the micrometer. The holder was then saw-slotted, drilled and tapped in the center for a knurled-head tightening screw. Now I can measure part of a circle just as easily as a completely bored hole. In use, the spindle is slipped in the hole of the holder, the tailstock is advanced and the spindle is slid down to touch the work, after which the

knurled screw is tightened. All that remains to be done is to pull the lathe around until the work comes to the top, and the barrel of the micrometer is adjusted to touch it.—Harry Moore, Hamilton, Can.

Measuring Diameter of Small Rod

A draftsman, who had no calipers to measure the diameter of a small rod, used a ruling pen instead, and found it entirely satisfactory for the purpose. The sharp edges of the ruling pen are placed on the scale and the exact measurement can be read more accurately than with calipers.—F. Harazim, New York City.

Homemade Lawn Harrow Cuts Up Grass Roots and Loosens Soil for New Seed

Handy Jig for Pulling Down a Bent Fender

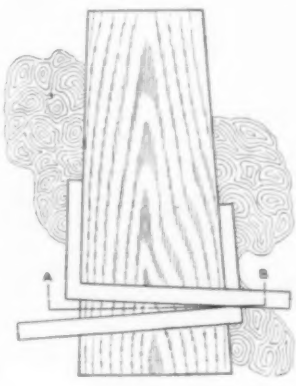
For straightening automobile fenders that are badly turned up at the ends, the simple device shown in the drawing has been found useful. It consists of a 3½-ft. length of ⅝-in. wire cable with a loop at each end. Attached loosely to the cable is a clamp made to fit the edge of the fender and having a setscrew for tightening it. The clamp is fastened on the edge of the fender, the loops at the end of the cable are slipped over a double hook, and the latter is slipped over a rim bolt on the wheel. The wheel is then jacked clear of the ground and revolved as shown to pull the fender down, the rope being passed under the hub.—Jos. C. Coyle, Denver, Colo.

Homemade Lawn Harrow Loosens Soil

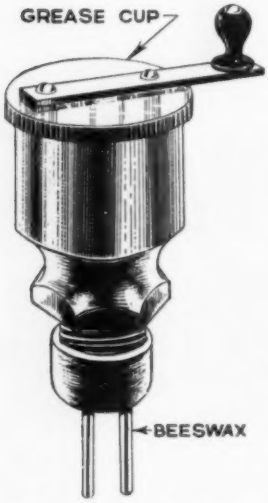
For loosening the soil of old lawns preparatory to seeding, the device shown has been used by a Pasadena gardener. It consists of a set of four sharp-edged disks, weighted down with a curved block of concrete, supported on a pair of rubber-tired wheels, and equipped with a lawn-mower handle, so that the worker can easily push it. When renovating lawns, particularly where Bermuda grass with its long runners is present, much of the original root stock is left in the soil, making it hard for new seed to take root. The lawn harrow cuts up the roots as well as the soil, making a receptive bed for the new seed. It is run across the lawn twice, at right angles.

Squaring a Tapered Column

A simple method of squaring the ends of a tapered column is indicated in the drawing. The square is placed at the point on one side of the column where it is to be squared, and a light line marked along the blade. The square is then reversed with the blade passing through the same point and a second line is drawn as indicated. Divide equally the angle between the lines thus made and the bisector AB will be the line along which the column should be cut to be square.—N. R. May, Louisville, Kentucky.



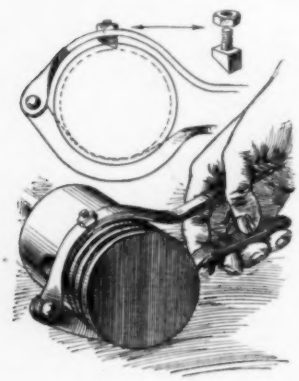
Grease Cup Used as Former for Making Wax Pattern Fillets



Patternmakers will appreciate the illustrated device for making wax fillets for patterns. It consists of a standard grease cup provided with a crank, and a pipe cap screwed on the end. One or more holes are drilled in the cap according to the size of the fillets desired. It is possible to make four or five different sizes at the same time. Ordinary yellow beeswax is put in the grease cup which is held vertically in a vise.—Ralph T. Stewart, Statesville, North Carolina.

Tool for Cleaning Piston-Ring Grooves

For the garage mechanic, who has frequent need of a tool for cleaning piston-ring grooves, the one shown in the drawing will be found useful. It is made of two strips of steel, 3/16 in. thick and 1 in. wide, each given a quarter twist at the end where they are pinned together. They are then bent to conform to the average diameter of pistons with the projecting ends left straight to form handles. A groove scraper is made for each width of ring in general use, namely, 3/16, 7/32 and 1/4 in. It consists of a small piece of square stock ground at a bevel and brazed or welded to a screw, which fits in a hole drilled through one handle and is held in place by means of a nut. In use, the scraper is inserted in the groove and the tool turned around the piston until the carbon has been removed.

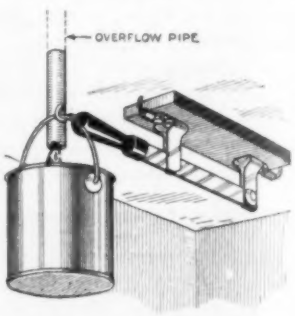


Replacing Valves

When replacing the valves in an auto motor after grinding them, it is frequently rather difficult to push the stem through the small washer while the spring is being compressed. By countersinking the hole in the washer slightly on one side, the valve stem can readily be pushed through.

Automatic Switch for Water-Pump Motor

In many homes where a motor pump has been installed in the basement to force soft water from the cistern into a supply tank in the attic, constant attention must be given to prevent the motor from running after the tank has been filled. To make an automatic switch, install a knife switch next to the overflow pipe as shown in the drawing. A screwhook is driven into the end of the switch handle to support a small pail, which, when suspended from the hook with the switch closed, hangs directly under the overflow pipe. As long as the can is empty the switch will remain closed, but as soon as enough water has entered the can, the additional weight will pull the switch open, stopping the motor. This extra switch is connected in series with the motor-control switch.—G. E. Hendrickson, Argyle, Wis.

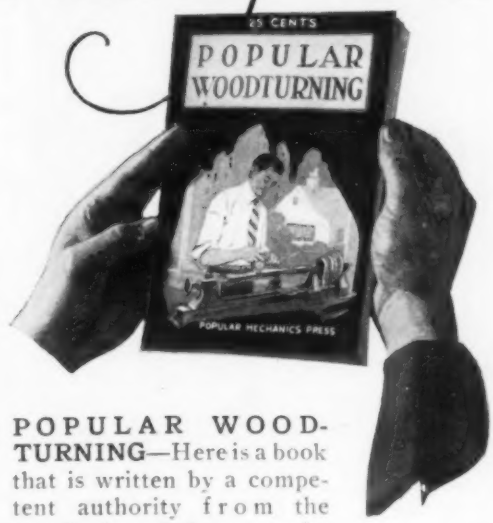


How to Prevent Plaster of Paris from Setting Quickly

In cases where work must be done with accuracy it is highly advantageous to retard the setting of plaster of paris. This can be done by adding citric acid, 1/4 oz., to every 25 lb. of plaster, which will delay the setting from 2 to 4 hours.

A New Service for You

TO provide additional help for its readers in solving their daily problems, Popular Mechanics Magazine has compiled a list of booklets on various subjects which may be obtained at cost by addressing The Librarian, Popular Mechanics Magazine, 200 East Ontario Street, Chicago, Ill., and inclosing the proper sum either in stamps or coin.



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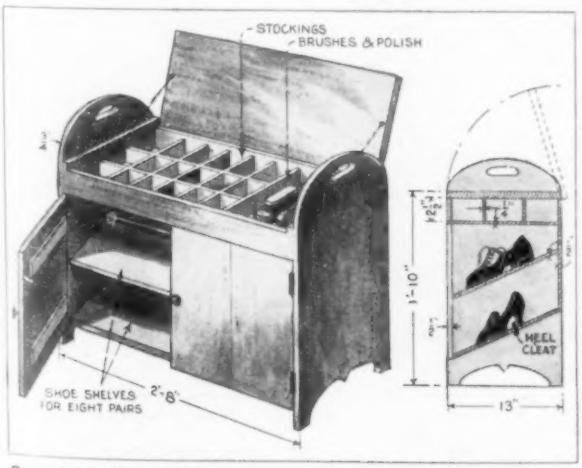

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MODERN INTERIORS—This interesting book is crammed full of suggestions for the home owner and for the small-shop craftsman who like to make their own built-in conveniences. Dining alcoves, kitchen cabinets, closets, dressers, bookcases, and a dozen other things, of simple construction but very attractive design, are described and illustrated in its pages. Not only are the details of construction given for each piece, but drawings show how the units may be combined into good-looking ensembles for kitchen, dining room, living room, bedroom and bathroom. Twenty-nine pages and plates. ..... Price Ten Cents.

Sheet Metal Is Used as Substitute for Wallboard in Miniature Exhibits

Sheet Steel Used for Exhibits

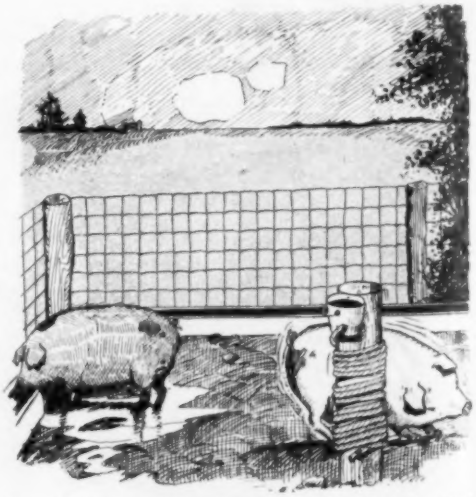
Wallboard has given way to steel, and the saw to the blowtorch in building cut-out backgrounds for miniature sets in the Los Angeles county permanent exhibit. It was found that in exhibits where water was used, wallboard or shellacked canvas could not be employed to advantage as these materials absorbed moisture and warped or swelled. Sheet steel has been found highly satisfactory for the purpose. The artist first daubs a sketch in rough outline on 3/16-in. steel plate and then cuts around it with an acetylene torch. The hot metal often runs along the edges, cooling in large drops, and this adds to the attractiveness of the finished job. A large number of miniature exhibits depicting various phases of agricultural and industrial activities, are on permanent display, one being a harbor scene with moving vessels in the water.

Ash Bin for the Basement

One way of avoiding the bother of carrying out the furnace ashes each week is to build an ash bin to accommodate all the season's ashes, which can be cleaned out during the spring at a nominal cost. Ordinarily a 4 by 4 by 4-ft. bin will be large enough, the sides being built up of common brick seconds with a door, about 6 in. wider than the coal shovel and about 18 or 20 in. high, located in the center of one side at the floor level. Its purpose is to permit the removal of the ashes. Another door or opening is provided in the top, which consists of No. 3 grade lumber, covered on the underside with sheet metal to prevent the possibility of fire. Frequently, when building a new house, there will be enough brick left after the chimney has been completed to build such a bin.—Edgar C. Hanford, Springfield, Ohio.

Hog Oiler for the Farm

By wrapping a heavy rope around a post set up in the hog yard, the upper end of the rope being inserted into a pail containing oil, and the lower end tacked to the post, an effective hog oiler can be improvised in a few moments at practically no cost. The pail into which the rope is run is also nailed to the post near the top, and it is kept well filled with oil. A hole to receive the rope should be punched from the outside and near the bottom of the pail, and after the rope has been pushed through, the bent metal at the edge of the hole is forced back again until it comes flush with the side, which will hold the rope securely and prevent excessive leakage of oil.—A. S. Wurz, Jr., Rockyford, Can.



Rope Wrapped around Post Serves as Wick in This Homemade Hog Oiler